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ISSUES CONCERNING THE SUSTAINABLE DEVELOPMENT AND USE OF WATER RESOURCES

Human development issues and water resources development in the 1990s

Report of the Secretary-General

SUMMARY

The worsening economic conditions faced by most developing countries since the 1977 United Nations Water Conference, as illustrated by the debt crisis, financial restructuring, world-wide recession and inadequate levels of official development assistance, have exacerbated the water problems faced by the rapidly growing urban and rural populations in those countries. In the face of this population growth and widespread poverty, immediate survival often leads to destructive environmental activities, such as cutting forests for firewood and timber and over-exploitation of both depleting aquifers and nutrient-drained soils. The reduction of poverty is therefore one of the basic conditions for reducing destructive environmental activities and achieving sustainable development.

Following an examination of the economic, social, demographic and environmental dimensions of human development issues and water resources development in the 1990s, the present report formulates a set of proposals for implementing a sustainable water resources development strategy. Particular attention is given to the institutional and financial factors required for the

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* E/C.7/1993/1.

implementation of a water resources development strategy that significantly contributes to human welfare and development. The report also stresses the importance of public participation and involvement by local communities as a critical component of water resources planning, development and management, in view of the fact that public participation increases the chances of successful implementation, cost recovery and sustainable operation of water projects.

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INTRODUCTION

1. The 1977 Mar del Plata Action Plan was a major policy statement and framework for action to prevent a global water crisis. Since then, great advances have been made, particularly in the area of drinking water supply as promoted by the International Drinking Water Supply and Sanitation Decade from 1981 to 1990. In the developing countries, more than 1.3 billion people have new or improved water supplies and over 740 million people have improved sanitation. Many more countries are practising effective forms of water conservation and great strides have been made in the expansion and intensification of irrigation.

2. Unfortunately, economic conditions have worsened since the United Nations Water Conference was held. The debt crisis among many developing countries, particularly in Latin America and sub-Saharan Africa, together with resulting financial restructuring, recession, shifts in the terms of trade away from commodities and inadequate levels of official development assistance, have worked to block, slow down or undermine investments in the water sector. In addition, Eastern European investment needs are now competing for the scarce international financial resources available. In their efforts to deal with debt and declining sources of income, much of sub-Saharan Africa and Latin America were net exporters of capital during the 1980s, although there has been a reversal of this situation in a number of Latin American countries, such as Chile and Mexico, during the 1990s.

3. Gains that have been made in areas like drinking water supply have been undermined by rapidly growing and poverty-inflicted populations. Human, industrial and agricultural pressures on water include increasing bacterial and toxic pollution, aquifer depletion, saline intrusion in coastal areas and salinization of soils. The spectre of water scarcity, forecast at Mar del Plata, is starting to become a reality in some regions. Human pressures on the environment produce deforestation, desertification, decreasing biodiversity, ozone depletion and global warming. These conditions reinforce each other in cycles of environmental degradation that have a direct impact on water availability and its use.

4. Properly managed and developed water resources can help in creating the economic, social and environmental conditions necessary to overcome these destructive external forces. Water management is, thus, both a victim of destructive environmental, population and economic forces and an approach for mitigating them. Appropriate water management and development requires technology, financial and human resources, relevant macroeconomic and institutional arrangements, and the political will to make the needed changes. In the water sector, technology is well advanced and is not a barrier to progress, although there is scope for innovations that can lower costs and lead to the appropriate, efficient and environmentally benign use of water. The real barriers are in providing the necessary financial resources under adverse macroeconomic conditions, devising the appropriate institutional arrangements and developing the political will.

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5. The present report focuses on some of the key human and institutional factors for implementing environmentally and economically sustainable water resources development. The Mar del Plata Action Plan was a pioneering effort in dealing with the problems of environmentally sustainable and human development, even though the concepts were not fully articulated at that time. The concepts have become much more focused in the past decade through the work of the 1987 World Commission on Environment and Development, the 1992 International Conference on Water and the Environment and the 1992 United Nations Conference on Environment and Development. Consequently, it is time to reassess how these concerns might be better incorporated into strategies for implementing the Mar del Plata Action Plan in the coming decades.

6. The report looks at the developing world rather than at the industrialized countries because that is where the most critical problems of water and human development are found. This emphasis does not imply that the stresses on the environment from the much greater resource exploitation in the North should be ignored, only that the human dimension to development is much more critical where poverty is the fundamental problem.

I. HUMAN RESOURCES CONSIDERATIONS IN THE CONTEXT OF SUSTAINABLE WATER RESOURCES DEVELOPMENT

A. Poverty and the human dimension

7. The World Commission on Environment and Development defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." 1/ If water resources development is to be sustainable, it must engage productively the people it is purported to serve without degrading or depleting the natural resource base in a manner that denies the benefits from its use or enjoyment to future generations. Sustainability of water supply systems must protect and enhance water-related activities and environmental amenities, while maintaining economic viability. 2/

8. People in the developing countries face formidable short-term pressures against the adoption of sustainable practices. In the face of widespread poverty and rapidly rising populations, immediate survival colours all thinking. If survival means cutting forests for firewood and building material, trying to squeeze an extra harvest out of nutrient-drained soils, or withdrawing water from a rapidly depleting aquifer, people will do so even though the resultant degradation will make life more difficult in coming years for them and their children. Economic and political uncertainty also force people to think more about the needs of today than of tomorrow.

9. Any hope of stopping short-term actions destructive to environmental sustainability requires a reduction in poverty. As asserted in Agenda 21, "a specific anti-poverty strategy is therefore one of the basic conditions for ensuring sustainable development". 3/

10. Other elements for achieving sustainable development include a reduction in population growth, a more equitable distribution of resources, a healthier, more educated and better trained people, a decentralized, more participatory government, a more equitable, liberal trading system within and among countries, a better understanding of the diversity of ecosystems and a better monitoring of the environmental impact of development activities.

11. Many of these elements concern developing the human population in a way in which they can successfully break out of the vicious cycles of poverty, population growth and environmental degradation.

12. Human development problems will differ from country to country and from one economic level to another. For many of the poorest countries, however, the preoccupations will be with the denial of choice associated with poverty.

13. While national planning and international assistance efforts have the goal of improving social and economic well-being, there is often a failure between intention and reality. Where planners aim at increasing social and economic benefits to a target population, they may regard the poor as the object of the exercise and not as active agents of change. In human development, people are central and must be treated as the prime actors in ensuring their own livelihood and in taking charge of their future. The institutional mechanisms for including the marginalized poor often do not exist, however, and they themselves generally lack the political power to demand participation when decisions that will affect their future are made. The poor and powerless are the ones forced to resettle to make way for a hydroelectric dam that will generate power for urban areas. In cities, they are the ones who will fail to receive basic water and sewerage if there is competition for scarce resources with wealthier neighbours, who may well be able to finance privately the needed water systems.

14. While the poor as a whole are generally underrepresented in water development planning, women and indigenous groups have even less power and face disproportionate hardship.

15. The role of women in the use and management of natural resources has been neglected by planners and policy makers, despite the importance women have in many of the decisions and activities related to local urban and rural water use, and despite the fact that women suffer the impacts from poverty more directly than men. In national accounting practices, women are overlooked because of their participation in areas in which it is difficult to collect data: small-scale agriculture, the informal sector and household work. Also, much of the water-related household work - carrying water and growing subsistence crops - are unpaid and not counted. Even where women are paid, their earnings are only a small portion of those of men. 4/ It is necessary to gain a better understanding of the real contribution that women make to the urban and rural water economy and ensure that they become full partners in the development process.

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16. Indigenous groups have often evolved a harmonious relationship with the natural environment. Many of the estimated 250 million indigenous people living in about 70 countries endow water and land with sacred meanings and see them as fundamental to their understanding of their own existence and identity. The concept of land as something to be bought and sold and used individually, instead of collectively, is alien to them. 5/ Without legal entitlements or means to influence outside actions, they have stood little chance as modern practices have encroached on their lands and waters. They are disregarded and, too late, it becomes apparent that the new uses put to the land cause environmental degradation and destruction of their ways of life. Moreover, the opportunity to understand their sympathetic relationship with the land and waters, and the lessons that can be learned in promoting environmentally sensitive and sustainable development, may be lost. Part of the challenge of human development must be to include these groups in the development process.

17. Water can be used effectively to fulfil certain economic objectives, which nevertheless ignore concurrent human development issues. For example, dams can be built and hydropower generated efficiently to fulfil predetermined technical and economic purposes that do not take account of the social and economic needs for water of the population around the area in which the projects are undertaken. Planners often try to increase economic benefits for urban populations without paying due attention to social returns from development, such as the provision of drinking-water supply, sanitation and small-scale irrigation for the rural poor. There is widespread recognition that for water projects and programmes to succeed in a meaningful sense, the people affected must contribute to and gain from their completion.

18. Water development should be compatible with and complement human and sustainable development. Clearly, much of water resources activity shares the aims of human development. The Mar del Plata Action Plan, for example, is based on the realization that:

> "[...] the accelerated development and orderly administration of water resources constitute a key factor in efforts to improve the economic and social conditions of mankind, especially in the developing countries, and that it will not be possible to ensure a better quality of life and promote human dignity and happiness unless specific and concerted action is taken to find solutions and to apply them at the national, regional and international levels." 6/

19. Most water development activity is directed at establishing conditions for a healthy and productive life through provision of clean water and sanitation projects and other economic projects. The need for knowledge acquisition has been recognized through training and skills development and the building of institutional capability. Water is *par excellence* a resource that can be used by farmers, fishermen, commercial and industrial users and many others as an input for achieving a decent standard of living. Nevertheless, there are still a number of obstacles to integrating human development more fully into the professional and political approaches that drive water development.

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20. Water resources development has a history of being an essentially engineering approach. It has been concerned with manipulating water resources to remove constraints on economic growth by supplying water and the services it can provide, or alleviating the unsanitary conditions that threaten public health. As non-structural alternatives may demand exceptional qualities of interpretation, judgement, responsiveness to local views and flexibility, political leaders, planners and donors may opt for an imposed structural supply-oriented development. To assure control, planners may favour projects that have a high technological or engineering component which may not fully involve the people in the development schemes, and may diminish or negate the human development impact.

21. The constraints on development in poorer countries often turn out not to stem from lack of river regulation or contaminated water supplies, but from the socio-economic conditions of the traditional society and the political-institutional weakness of local, regional and national Governments. In other words, technological innovation tends to outpace the social adaptation needed to make the technology a success.

22. A prerequisite to water projects is the social and economic capability to make use of them. Priority must be given to understanding the needs and capabilities of the target populations and providing the education, incentives, backup services, institutional support and financial resources needed to involve the people more effectively in proposed developments.

B. Impact of structural adjustment and macroeconomic policy

23. The large debt load faced by most developing countries has led to the use of structural adjustment and sectoral adjustment loans in which the International Monetary Fund, the World Bank and other international lending institutions impose strict conditions on financial assistance. These conditions focus on promoting exports through devaluation, deregulation of markets, privatization of public entities, easing of import restrictions, reductions in subsidies and other budgetary cutbacks. 7/ Many countries, disillusioned with structural and interventionist policies, are on their own adopting similar market-oriented macroeconomic policies. Some of these reforms aimed at improving efficiency and strengthening institutional capacity can complement reforms needed to give people a greater influence in water management.

24. In particular, reforms to policies that result in distortion of water use deserve careful consideration. For political or strategic reasons, such as food self-sufficiency or industrial policy, Governments may subsidize productive inputs such as water or electricity. For example, in the developing countries, electricity generation is subsidized in the range of 92 to 65 per cent. For irrigation, the effective price charged for water is only about 35 per cent of the average cost of supplying it. 8/ The World Bank has found that only a few countries, for example, Turkey, the Philippines and the Republic of Korea, charge users the full cost or more for electricity and no country charges the full cost for irrigation water. 9/

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25. Other distorting policies include price controls on food and use of food aid to maintain low prices. These undercut the costs of local production and give the local farmers little or no incentive to invest in improving crop productivity, through irrigation or other means, or even to stay on the land. Urban populations benefit, but the cost may be the destruction of the rural agricultural economy and increasing urbanization. Removal of such practices must, however, be tempered by consideration of the impact on public welfare to ensure a balance between the need to stimulate the agricultural sector and to maintain affordable food supplies.

26. In a number of cases, the rigorous application of structural adjustment policies on water and human development has been detrimental. Increased exports for commodity-based economies have failed to materialize in the face of barriers to such trade from the developed countries and of a shift in the direction of international trade towards high-technology services and manufactured goods. Devaluation has led to inflation in the cost of necessary imported equipment. Development programmes have been sacrificed to general austerity measures. Maintenance of existing water delivery systems have fallen into disrepair because of lack of funds. Equity has been given little consideration and relative income disparities have widened, with poverty becoming more widespread. Women have borne the greater burden from the reductions in social services, education and health and the removal of subsidies on food. Longer-term investment programmes in water development and environmental sustainability have given way to short-term perspectives and emphasis on financial returns. The priority that should be given to the elimination of poverty and the promotion of human development has been ignored. Since the onset of the debt crisis, many developing countries have become net exporters of capital at a time when they need a net infusion.

27. It is clear that in the examination of structural adjustment and macroeconomic policies, consideration should be given to the specific conditions of each country. Such policies should make available appropriate levels of financial and institutional support for water investments that are essential to achieve basic levels of human health, to meet medium- and long-term development goals and to sustain fragile environmental resources. In general, they should accommodate the need for financial resources to overcome many of the institutional obstacles in the way of engaging people productively in the economy.

II. LOOKING TO THE FUTURE

A. Public participation

28. Public participation is one of the most important aspects of successful and sustainable water development. It is also a critical process in ensuring human development. Participation is necessary for developing consensus and commitment within the local community to make the project or programme work; integrating local values, knowledge and experience into development planning and design; and providing a means of resolving conflicts over resource use.

29. Responding to the needs and interests of the people is the key organizational approach to human development planning, as well as being essential for ensuring success in more traditional-directed planning efforts. The target populations are the ones, and the views of women should be particularly noted, that can decide best on location of facilities, the most appropriate technology for their needs and arrangements for operating and maintaining any systems that are introduced.

30. Local involvement increases the chances of successful implementation, cost recovery and sustainability of projects. The World Bank reviewed 30 of its projects and found an average rate of return of 18 per cent for projects that were considered culturally appropriate and only 9 per cent for projects that did not include mechanisms for social and cultural adaptation. The United States Agency for International Development looked in detail at 52 projects and found strong correlations between participation and project success. The study noted, in particular, success when participation took place through organizations created and managed by the beneficiaries themselves. 10/

31. The practical experience of local people should be a critical component in development planning. Far too many projects have failed to take account of that experience. For example, in Bali, a large internationally financed agricultural project set out to introduce high-input, imported rice varieties. A sudden increase in insect pests and declining crop yields ended the experiment. Subsequently, the project was relaunched, but this time adopting local practice, based on the Balinese irrigation calendar, which made the most of the irrigation water, conserved soil fertility and controlled pests. 11/

32. Development programmes tend to alter the economic and resource use relations of the people in the region because some are in a better position to take advantage of the changes. It is essential, therefore, to establish mechanisms for dispute resolution. Large-scale regional projects, such as river basin developments, need to have local input. Such projects tend to be "top down" in conception and implementation. The local population needs to participate to mitigate the damages and conflict that may arise from forced resettlement or disruption in their traditional agricultural practices.

33. Participation can delay decisions and even lead to projects not going forward. The reluctance to sponsor projects that may be of benefit to society, such as waste sites, is common when a community is asked to bear their costs or risks. To explain and win consensus, often when information is inadequate, and to reconcile competing interests, requires skills not always found in largely technical organizations concerned with water resources. The process can be highly consumptive of staff time. The administrative and organizational burden is heavy, particularly in developing country organizations that may lack sufficient skilled staff.

34. The effort needs to be made. For an irrigation project in the Philippines, for example, it was estimated that the additional cost for

community participation was about US$ 25 a hectare. In return, however, the farmers' local knowledge reduced the costs of construction, with the result that the net increase was reduced to less than US$ 2.50 a hectare, the overall irrigation project was better designed, it had higher user participation and higher revenues. 12/

35. Both Agenda 21 and the report of the International Conference on Water and the Environment stressed the principle of delegating water resources management to the lowest appropriate level. It is clear, however, that a "bottom-up" approach, if left to its own devices, would not be able to respond to all requirements for the sustainable development and management of water resources. There is a need for close interaction between management institutions at the lowest appropriate level and those at the regional and national levels, thus ensuring that adequate support is given to local institutions.

B. Institutional setting and legal arrangements

1. The institutional setting

36. In integrating the human development perspective more fully into water resources planning, the barriers that prevent the poor and marginalized from participating fully in the modern economy need to be removed. An obstacle to using market-based approaches is that without income or capital the poor cannot turn their very real needs for clean water, sanitation, electricity or irrigation water into demands that will be recognized by the market. The most basic task is then to make them effective economic players in their country's economy. This requires efforts at institutional reform, that is, creating the conditions in which participation can take place, such as legal entitlements, proper economic incentives, technical support and training, and participation and representation in the planning decisions.

37. The market is an imperfect mechanism for doing what it does best, that is, promoting economic efficiency, let alone for promoting social equity. Consideration of institutional arrangements needs to take into account the distortions, such as subsidies for resources use, that impair the market economy and the failures of the market and economic analysis to account for important social and environmental factors.

38. Competitive markets do not always allocate resources efficiently or establish prices that reflect true economic, social and environmental values. The hidden contribution of women to the economy, the failure to account for externalities and the resulting environmental and cultural damages to unrepresented groups are seldom taken into account adequately.

39. Water supply, sanitation, wastewater treatment and irrigation water are likely to be under-supplied by the market. Where the service, such as water supply and wastewater treatment, is a natural monopoly, an unregulated private market supplier would restrict the service to raise prices. In other cases,

such as providing storm-water drainage, there is little incentive to supply the service because the cost of excluding users who do not pay is too great. 13/

40. Governments, therefore, have an important role in providing water infrastructure but the intervention needs to be carefully considered. Generally, where the benefit to the user is high, such as for water supply and wastewater collection, there may be little need for government subsidies for investment and operational costs. A study in north-east Thailand showed that willingness to pay was much greater than planners had thought. They had watched their basic hand pump and motor pump/standpipe water supply schemes fall into disrepair. Finally, they learned that the people wanted yard taps. Within five years, 90 per cent of the systems were functioning reliably, 80 per cent of the people were served, meters had been installed, and locally adapted charging systems had been developed. 14/ Where the social benefits to society are greater than to the individual, such as wastewater treatment, Governments may need to subsidize part of the costs.

41. As both the final report of the International Conference on Water and the Environment (A/CONF.151/PC/112, annex II) and chapter 18 of Agenda 21 stress, cost recovery, particularly with regard to ongoing costs, whether collected by the Government through fees or taxes, or user groups, is important. Financial resources are scarce in any country and particularly so in the developing ones. Without income to cover operations, the project is not self-sustaining and must rely on a continuing commitment by Government, which is problematic in the current and immediate future economic climate.

42. Giving greater recognition to human development in water resources planning in the coming decades means changing the status quo. There will need to be a political commitment to social equity and some basic process values to ensure effective involvement by women, traditional subsistence farmers, indigenous people and other groups poorly represented in planning and decision-making. Governments must set in motion the conditions that will enable them to have a voice in the decisions that affect them. Because full participation of underrepresented groups in economic decision-making will lead to policy reform, Governments may face a redistributional backlash from those groups whose privileged economic and political standing will be threatened. Such reform will require a strong political will.

43. Basic institutional reforms will have to be made to permit greater participation by the poor. At a minimum, these arrangements must be responsive to public concerns and interests. They must also ensure the political accountability of political leaders and planners to the public that will be affected by their decisions and actions. There must be opportunity for participation or public input in the planning, implementation and operation of projects and programmes. Above all, to build confidence in the institutions, the institutional arrangements and decision-making processes must be transparent.

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44. An examination of the institutional arrangements includes:

(a) The policy elements, including macroeconomic and other national policies that affect water and human development;

(b) The legal regime, which includes water- and land-rights, customary uses, transferability of rights;

(c) Organizational arrangements, i.e., the way Government organizes water policy-making, programming, allocation and management among the local, regional and national levels, as well as providing for public participation;

(d) Programming approaches, which take into consideration the views of local communities.

45. Where actions are taken for social reasons, it is important that they be evaluated against other priorities for use of scarce funds to ensure maximization of social gains.

2. Legal rights and obligations

46. Marginal groups and indigenous peoples may have poorly defined or non-respected rights to the land and water they use to subsist. Without secure tenure, there is little incentive for farmers or urban slum dwellers to make the investments and improvements needed to improve their physical conditions and productive capabilities. Nor will they be willing partners in government development programmes that affect their relationship to the land and water.

47. Thailand offers a positive example of what can be achieved with the assignment of ownership, titles and tenurial rights to land. These changes in recent years have given farmers the incentive to invest in soil conservation and land improvement, with consequent reduction in soil erosion. 15/ With recognized rights to land and water, the holders will have an incentive to make improvements and conserve resources.

48. Communal rights of indigenous groups often go unrecognized and that can have disastrous consequences for those groups and the environment. Governments' development efforts that disregard the traditional rights of these groups will at best engender suspicion and hostility, at worst lead to the destruction of their subsistence economy.

49. Community property systems deserve recognition as they can be highly effective in managing water and related land uses. Such traditional legal arrangements control access and use for irrigation, groundwater, fisheries and other water uses. When Governments are formulating new legal arrangements they should recognize the traditional systems and protect them from encroachment. A legal system that recognizes traditional practices and demands compensation for their elimination is essential to ensure the

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progressive integration of indigenous and other common property groups into the development process.

50. Governments, however, need to be aware that, in cases of common ownership, there are incentives for individuals to take too much from the community resource - water extraction, waste discharge - since the cost of their actions is borne by the community as a whole, while they can enjoy full benefit from their socially irresponsible actions. Community systems traditionally have means of regulating internally such activities but in times of economic change or environmental and economic breakdown, destructive individual behaviour may take hold. Governments need to oversee such communal arrangements to ensure equity in the distribution of output of common entitlements and activities, limitations or controls in the disposition of common land and water entitlements, and accountability of managers and representatives.

C. Integrated water resources planning and management

51. Water development encompasses much too broad a range of activities and approaches to allow for categorical generalizations on how planning, implementation and management should be organized. The differences in quantity and distribution of water; level of industrial and agricultural activity; national, regional and local income levels; social, cultural and political conditions; and constitutional arrangements all make it impossible to recommend a single framework for coordinating and planning water development in a manner that encourages human development. Nevertheless, some organizing considerations can be suggested.

52. The institutional framework must represent the interests of all parties affected by water development and management. Mechanisms are essential for coordination of national, sectoral and project agencies. Irrigation, fisheries, river navigation, hydroelectric power, wildlife, and forest management may all be represented by different departments or agencies. In federal States the jurisdictions become more complex since the senior level of government takes responsibility for some water-related sectors and the junior level others. Municipalities add a third tier. Pressures to empower indigenous groups may add another.

53. The watershed is often taken as the ideal boundary for bringing rationality and order to the planning process. The Tennessee Valley Authority (TVA) is the organizational model that has been taken up in a number of river basins, particularly international ones. The river basin or watershed is certainly the basis for carrying out needed planning activities, such as water surveying and water quality monitoring, and the basin is an important natural unit in assessing the environmental impact of projects. But as an organizational model, it has rarely survived the entrenched opposition of strong sectoral departments.

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54. The watershed remains the basis for planning and analysis, but the organizational arrangements are destined to remain a complex overlapping set of entities. If organizational complexity is accepted, there must be strong mechanisms for inter-sectoral planning and coordination and a mechanism for water policy-making and monitoring as well as for conflict resolution.

55. Planning and coordination can work at the local level. For example, in Jakarta a number of different agencies were able to implement a relatively successful programme to protect the metropolitan area's ecologically sensitive watershed by shifting growth away from the watershed. 16/

56. Policy on water use should be separated from implementation and delivery. Priorities in the use of resources often become distorted if there is no policy overview from an independent agency to advise on policy and priority setting among competing sectoral water agencies. For example, an agriculture department promoting irrigation could appropriate most of a country's water supply. This appropriation to an essentially low-value water use may block higher-value urban or industrial uses. A policy agency or some other institutional coordinating mechanism should review agricultural needs in relation to other uses to determine use priorities and the allocation of national resources that could be devoted to each sector. Given that water is integral to environmental considerations, water policy-making and monitoring should be done in coordination with the agencies responsible for environmental policy.

57. The formulation of national action plans with the input of local and regional groups could provide a firm basis for the policy agency's continuing role in policy formulation and monitoring of policy implementation. It could make use of local and regional advisory bodies to ensure that local priorities are taken into consideration on an ongoing basis.

58. The line agencies themselves should be organized with input from and, where appropriate, operation by local user groups. The decentralization of line departments and the devolution of responsibilities to outside organizations and groups will differ in accordance with conditions and readiness for full participation of those groups. They may need strengthening through technical assistance, management training and gradually increased levels of responsibility. The most effective user groups are the ones that reflect their society and enjoy widespread local support.

59. There may well be equity considerations in devolving responsibilities to local groups. For example, the contribution of women to all facets of water sector activities should be accounted for in local groups. Similarly, devolution should not reinforce local disparities and social inequities by giving unrepresentative authority to certain local privileged elites.

60. The use of local volunteer organizations and non-governmental organizations offers a means to work effectively at the local level. They may be more flexible and able to function better than state agencies in remote areas, deliver low-cost appropriate technologies and involve the people more

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directly. They also can have an important feedback function by reporting on the way programmes and agencies are operating at the local level.

61. Devolving services encourages the use of local resources and may reduce administrative costs. On the other hand, it makes it more difficult to achieve national standards and may reinforce disparities between regions.

62. There is a need for Governments to reconcile conflicting demands emerging from the public with national water, environmental, fiscal and sectoral priorities. One way is to develop a national water or environmental plan that incorporates the views of all people and agencies that would be essential to implement it. Canada successfully developed a National Water Policy on the basis of widespread consultation by an independent commission. The World Bank comments on the consultative experience in developing a national environmental action plan in Burkina Faso as follows:

> "Although it might have been quicker and cheaper to produce the plan using international consultants, the plan would not have been a Burkinabe product and would probably have joined other 'external' products on a bookshelf instead of resulting in action." 17/

63. Such action plans can serve as an effective vehicle for assigning water use and development priorities; identifying financing, skills and technology gaps; and serving as a framework for negotiating with international and bilateral lending agencies the allocation of development assistance. Since water is so intimately connected with environmental considerations, such plans should be developed in conjunction with efforts to develop national sustainable development strategies.

64. Water development is directed at supplying water for drinking, industrial use or irrigation. It may also solve flooding, water pollution or other water-related problems. Finally, development may take advantage of an opportunity such as a dam site for hydroelectric power development. 18/ Although neglected in the past, water planning should take fully into account that water is central to ecological systems and in its natural state is vital to the preservation of wetlands, other environmental and amenity values and traditional lifestyles.

65. An underlying consideration for both efficiency and equity concerns will be the provision of good information. Monitoring and evaluation information is critical in effective water management. The line agencies should be able to monitor local progress and feed information back to headquarters and the policy-making agency. Governments and the public will need information on emerging problems and opportunities, the nature of the problems, the options for solving them, the costs and benefits and how they will be distributed, and an evaluation of the progress being made.

III. CONCLUSIONS AND RECOMMENDATIONS

66. The challenge is to implement water development in a manner that contributes to human welfare and development. When broader social goals are sought, success in supplying water and success in promoting human development are interdependent. Quite simply, the recipients of the benefits of water development and those delivering them must have the means to sustain that development.

67. The mixed success of much water development lies in the fact that people lack the incentives and means to sustain it. Poor and often unable to influence political and planning decisions, they face major sets of obstacles that hinder making the water projects a self-sustaining success and effecting the socioeconomic transformation to allow them to participate effectively in the modern economy. Circumstances vary from region to region, but the obstacles they face may be inadequate information, skills, capital, economic incentives and institutional support to participate and take advantage of development opportunities.

68. The world's poor are marginalized and do not effectively participate in the processes that are supposed to better their lives. Since water is a resource of value, there will be competition and conflict over who will claim the benefit from its use. The poor, however, can seldom make their voices heard and their needs will be neglected or misrepresented.

69. To integrate human development into water resources development requires a shift in thinking. Instead of doing for and to people, there must be a recognition that the people will be the ones doing for themselves. Development planning then becomes a process of responding to their needs and helping them live up to their potential to better their economic and social conditions.

70. The shift in thinking is not so much with regard to objectives as with the process and approach. Human development is people centred, a "bottom-up" approach founded on a strong ethical base of equity and participation. It approaches development as a process, which can be sustained only through the involvement of the people most directly affected. It is inclusive, drawing in women, indigenous groups and more generally the rural and urban poor who are too often excluded from development programmes designed to assist them.

71. Often, programmes are put in place that rely on the participation of these peoples but fail to provide effective financial, material and institutional arrangements needed for the programmes' success. Instead of becoming beneficiaries, they become the victims of development. Focusing on the human side of development attempts to integrate the marginalized peoples into the decision-making process so that it can transform their condition. Making the programmes a success will require the political will to make domestic changes, implementation of appropriate policy and institutional changes and the commitment from the international community to alleviate some of the more pressing economic constraints holding back development.

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72. To achieve compatible human and water resources development reforms need to be undertaken in a number of areas.

Poverty

73. Water resources planning should focus on the relationship between water and poverty in urban and rural areas. As asserted in Agenda 21, "a specific anti-poverty strategy is therefore one of the basic conditions for ensuring sustainable development". 19/ Addressing poverty is also essential in developing the capability in people to use productively and conservatively the water resources available to them.

Human development

74. Water resources planning and management should become more people centred. Priority must be given to understanding the needs and capabilities of the target populations and providing the training, incentives, backup services, institutional support and financial resources needed to involve people more effectively in the proposed developments.

75. Responding to the needs and interests of the people should be the key organizational element to "bottom-up" human development planning, as well as being essential for ensuring success in more traditional-directed planning efforts. As chapter 18 of Agenda 21 emphasizes, this involves the strengthening of the functioning of Governments in water resources planning and, at the same time, giving full recognition to the role of local authorities and community-based organizations in this process. 20/ In the end, water resources planning and development should be based on a broad participation approach, involving users, planners and policy makers at all levels.

76. Emphasis should be given to public health in both urban and rural areas where the lack of clean water and good sanitation imposes a health handicap.

Research

77. Greater efforts need to be made to determine the real value of women's contribution to the water economy of poor rural and urban areas and to develop gender-sensitive research on the role of women in the management and conservation of water resources and the impact on them of environmental degradation, desertification and excessive use or misuse of water.

78. Similarly, research should be encouraged on the traditional water and land use practices of indigenous groups to determine how or whether they can be adapted in promoting human and water resources development.

Participation

79. Public participation should be a fundamental aspect of water planning. It is essential to recognize that people must be the agents of change in promoting their own development and that they cannot be effective unless they have the opportunity to participate and influence the process that will bring about change.

80. Efforts should be made to identify the informal as well as the formal groups affected by water development. Women's groups could be overlooked if the effort is not made to identify and encourage their participation, which could be essential for success in the implementation of programmes for urban and rural water supply and sanitation, and agricultural water projects.

81. The participation of traditional and local groups should be incorporated in any water planning or land use changes that may affect them. Their practical experience and support are necessary to successful planning.

82. Given that water has value and development of the resource will entail significant distributional considerations, provisions for public participation should include mechanisms for dispute resolution.

Environment

83. Water resources development should take fully into account the fact that water is central to ecological systems and, in its natural state, water resources are vital to the preservation of wetlands, other environmental and amenity values and traditional lifestyles.

Subsidies and cost recovery

84. The uses of subsidies for water projects should be considered carefully to avoid the wasteful use of water and scarce investment funds. They should only be applied when the social benefits to society are greater than to the individual.

85. Price controls and subsidies for food should not reduce the cost of domestic foodstuffs to a level at which there is no longer a price incentive for the farmer to produce for the market or to invest in more intensive production.

86. To the extent possible, investments in water should be recovered through taxes and user fees so as to avoid dependence on continuing government subsidization for payment of recurrent costs and to ensure the water projects are self-sustaining.

87. It is important to recall the emphasis that the International Conference on Water and the Environment gave to the concept of water as an economic good. In this regard, both the Conference and Agenda 21 noted that:

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> "Planning considerations should reflect benefits investment, environmental protection and operation costs, as well as the opportunity costs reflecting the most valuable alternative use of water. Actual charging need not necessarily burden all beneficiaries with the consequences of those considerations. Charging mechanisms should, however, reflect as far as possible both the true cost of water when used as an economic good and the ability of the community to pay." 21/

Water rights

88. A stable yet flexible system of water rights, whereby rights can be assigned and transferred to individuals as well as to customary users and collective groups, should be a goal.

National water plans

89. A national water action plan should be implemented that reflects the view of the people and can serve as a framework for allocating water among sectors, identifying training, technical and financial needs, and serving as the basis for negotiating development assistance. The plan should be implemented in coordination with the formulation of sustainable development strategies.

Organization

90. The institutional setting for the formulation of a national water policy should be separated from those organizations responsible for implementation and delivery. The arrangements should ensure that no one sectoral organization can appropriate water to the detriment of achieving an optimal allocation of water within a country.

91. As much as feasible, water delivery should be devolved to the regional and local level with the participation of local user groups. The use of local volunteer organizations and non-governmental organizations should also be considered as a means to work effectively at the local level.

92. Given that water is integral to environmental considerations, water policy-making and monitoring should be done in coordination with the agencies responsible for environmental policy.

Macroeconomic and structural adjustment policies

93. Appropriate levels of financial and institutional support should be made available where water resources investments are essential to achieve basic levels of human health, to meet medium- and long-term development goals or to sustain fragile environmental resources.

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Development assistance

94. Working out appropriate institutional arrangements will help in promoting human development and in making for more successful water development. It is apparent, however, that many of the poorest countries start from a level in which financial resources and skills are not available. The situation a number of countries face, that of a net exporter of capital to meet debt obligations, makes the situation even more desperate. Clearly, most developing countries need some forms of assistance to initiate the process of reform and development. Instead, they face the obstacles of debt and a reluctance of many of the more wealthy countries to commit more of their own resources to official development assistance. Overall, they are committing about 0.3 per cent of their gross domestic product to such assistance. Agenda 21 calls for a commitment of 0.7 per cent. Innovative assistance strategies need to be developed to boost necessary investments in water and associated human development programmes. Consideration should be given to debt forgiveness, enhanced bilateral assistance programmes and strengthening multilateral financial and technical programmes.

95. What is most needed from external support agencies, including development banks and multilateral agencies, is long-term reliable funding, especially for human development, institution building and research, as they are essential for the success of the implementation and operation of water resources development projects. This implies shifting focus away from short-term, physical projects primarily aimed at creating opportunities for contractors and manufacturers in recipient countries. Greater priority should also be given to technical assistance designed to strengthen local capabilities and to provide appropriate technologies, as opposed to the more common capital-intensive and advanced technology assistance.

Notes

1/ World Commission on Environment and Development, Our Common Future (Oxford, Oxford University Press, 1987), p. 43.

2/ United Nations, Department of Technical Cooperation for Development, Demand Management, paper prepared for the International Conference on Water and the Environment, p. 9.

3/ See Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992 (A/CONF.151/26/Rev.1), vol. I, chap. 3.

4/ United Nations Development Programme, Human Development Report, 1990 (Oxford, Oxford University Press, 1990), p. 32.

5/ World Bank, World Development Report, 1992 (Oxford, Oxford University Press, 1992), box 4.6, p. 94.

Notes (continued)

6/ *Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977* (United Nations publication, Sales No. E.77.II.A.12), chap. I, p. 3.

7/ Morris Miller, *Debt and the Environment: Converging Crises* (United Nations publication, Sales No. E.91.I.17), p. 70.

8/ World Bank, *World Development Report, 1992* ..., p. 104.

9/ Ibid., p. 69.

10/ Ibid., p. 95.

11/ Ibid., pp. 93-94.

12/ Ibid., p. 96.

13/ Ibid., p. 81.

14/ Ibid., p. 106.

15/ Ibid., p. 68.

16/ Ibid., p. 89.

17/ Ibid.

18/ United Nations, Department of Technical Cooperation for Development, *Integrated Water Resources Planning*, paper prepared for the International Conference on Water and the Environment, p. 6.

19/ See *Report of the United Nations Conference on Environment and Development* ..., vol. I, chap. 3.

20/ Ibid., chap. 18.

21/ Ibid., para. 18.16.

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CROSS-SECTORAL PRIORITY PROGRAMMES FOR COORDINATED ACTION BY THE UNITED NATIONS SYSTEM IN THE AREA OF WATER RESOURCES: INFORMATION MANAGEMENT

Report of the Secretary-General

SUMMARY

The integrated management of information concerning water resources, together with other physical, environmental, demographic and socio-economic data, is an essential component in the rational use and protection of finite and vulnerable water resources. Yet, the widespread absence of comprehensive information seriously impedes a meaningful monitoring of the water resources situation at the national, regional and global levels. The present report suggests that the objective of a monitoring system should be to act as an indicator of areas of opportunity, and as a warning system of areas at risk. Whenever possible, the unifying geographical unit for the treatment of information should be the watershed or groundwater basin.

The rapid evolution in the field of electronic data processing that took place during the 1980s has made a number of geographical information systems (GIS) readily accessible for use with personal computers. There are, difficulties, however, in their application, stemming from the limitations connected with the reading of data in various formats and those inherent in the very nature of remote sensing data. In 1992, the former Department of Technical Cooperation for Development of the United Nations Secretariat started a feasibility study on the interfacing of data stored in different programmes into a geographical information system. It is expected that a pilot programme will be conducted in the near future in order to test the applicability of such an interface and to assist Governments in strengthening their capacity for information management. At the global and regional levels, the organizations of the United Nations system are studying means to establish a system-wide integrated monitoring and assessment network with a view to monitoring the state of the world's freshwater resources.

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* E/C.7/1993/1.

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INTRODUCTION

1. The Mar del Plata Action Plan of the United Nations Water Conference, held in 1977, called for an integrated approach to policy formulation, and the establishment of legislative and administrative guidelines, and recommended that countries should improve the availability and quality of necessary basic information. 1/

2. In Agenda 21 of the United Nations Conference on Environment and Development, the Conference stressed the need for "the holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy". 2/ The Conference recognized the close interrelationship between water and other natural resources, as well as between water and other socio-economic factors. Thus, in Agenda 21, it was stated that all States could implement, inter alia, "integration of measures for the protection and conservation of potential sources of freshwater supply, including the inventorying of water resources, with land-use planning, forest resource utilization, protection of mountain slopes and riverbanks and other relevant development and conservation activities", 3/ and "development of interactive databases, forecasting models, economic planning models and methods for water management and planning, including environmental impact assessment methods". 4/ In addition, it was pointed out, also in Agenda 21, that prevailing systems of decision-making in many countries tend to separate economic, social and environmental factors at the policy, planning and management levels.

3. Owing to a widespread absence of comprehensive information for water resources management, a meaningful monitoring of water resources at the national, the regional and the global level has been fraught with serious difficulties. More often than not, critical information is not available or, if available, is not sufficiently timely, reliable or comprehensive. Most important, data on a diversity of physical, demographic, economic and social parameters that should be essential to planning and the management of water resources for sustainable development are (if and when available) often collected and processed in a fragmented manner lacking a holistic perspective on the type of data set required for such management. As noted in chapter 40 of Agenda 21, concerning information for decision-making, "there is a general lack of capacity, particularly in developing countries, and in many areas at the international level, for the collection and assessment of data, for their transformation into useful information and for their dissemination. There is also a need for improved coordination among environmental, demographic, social and developmental data and information activities". 5/

4. The present report presents the outlines of an incipient system-wide programme for addressing the current shortcomings with regard to information management in the light of monitoring requirements at the national, regional and global levels. The programme aims to address issues related to assisting Governments in establishing or strengthening their capacity to manage information in a manner suited to the integrated management of water resources. It also addresses issues related to the establishment of a network able to yield sufficiently comprehensive information for regional and global monitoring in the context of the Mar del Plata Action Plan and the follow-up to the

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Conference, particularly in the light of the call within Agenda 21 for a strengthening of "local, provincial, national and international capacity to collect and use multi-sectoral information in decision-making processes". 6/

I. OBJECTIVES AND SCOPE OF AN INTEGRATED INFORMATION SYSTEM

5. It is suggested that the objective of an integrated monitoring system should be to act, on the basis of analyses of reasonably reliable and timely data, as an indicator of areas of opportunity for sustainable socio-economic development, and as a warning system regarding current or future areas at risk, with a view to directing resources towards priority issues and urgent programmes.

6. For a system to be able to achieve this objective, it is necessary that data concerning key variables be stored and processed in such a manner as to provide a suitable understanding of the current situation, and to constitute a tool for predicting the probable impact of existing trends and policy options. This requires that information be available not only about water resources, both from a quantity and a quality point of view, but also about the probable effect of water resources development and utilization on other variables such as land use, land degradation, biodiversity and climate change. If this type of understanding is to be achieved, there is a need for an approach to data management that links physical, hydrological and hydrogeological information (concerning both quantity and quality) with water-use data, demographic information, land-use and degradation data, data concerning the use of pesticides and fertilizers, industrial production data, and other relevant variables.

7. If data are to become useful as a means of providing information about areas at risk and areas of opportunity, they have to be linked very closely to the concrete geographical units to which they refer. Data tend to lose their information value as their geographical context becomes more diffused. Ideally, water resources-related data should be collected and analysed within the context of the watershed or the groundwater basin. Failing that, political or administrative units at varying levels of aggregation can function as the basic integrating unit. While hydrologic and hydrogeologic data, including water-quality data, are normally treated in the context of the river or groundwater basin, this is not the case for other types, such as information on water-supply and sanitation service coverage, and demographic and economic data, which are usually collected at the level of the administrative political unit, or even at the national level. Although such data can still be very useful as indicators of certain trends, efforts need to be made, to the extent feasible, to organize the collection of data at the level of the smallest convenient unit which can then be related to the individual watershed or groundwater basin.

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II. INFORMATION MANAGEMENT ISSUES AT THE NATIONAL LEVEL

A. The current situation

8. Many developing countries currently lack the capacity needed for the collection, collation, analysis and display of the information required for the holistic management of water resources in the context of sustainable development. This is often due to a lack of reliable data in a suitable form and of horizontal and vertical integration among governmental organizations dealing with various aspects of water resources development and management, and among those dealing with socio-economic planning.

9. With regard to the assessment of water resources, the reviews carried out in the context of the follow-up of the Mar del Plata Action Plan, and more particularly the review carried out in 1990 for the purpose of formulating a strategy for the implementation of the Action Plan in the 1990s, showed that there were still considerable deficiencies in the availability of data, particularly with regard to groundwater and water quality. In many instances, data-gathering hydrologic organizations have fallen prey to the budgetary constraints of the 1980s. In fact, as evidenced by the recent series of hydrologic assessments of sub-Saharan Africa, the hydrologic organizations over most of the African continent have reached a nadir in terms of activity and functionality. Expenditure and maintenance budgets have been cut consistently and there remain very few well-maintained surface-water monitoring stations throughout the continent.

10. Efforts in the field of hydrologic data management have concentrated on the operational aspects - data collection and data processing - that is, on the production of data. Little attention has been paid to the elements of data management in the post-processing stages, such as those of data manipulation, evaluation of user needs, and reporting and dissemination (in other words, data consumption). It may be that part of the financial and institutional problems experienced by water resource organizations have to do with those organizations' lack of regard for the data consumer. On the other hand, the reluctance on the part of some Governments to publish data often means that potential consumers of such data are unaware of what is available. Indeed, it is the demand for data that should (along with statutory requirements) drive their production and thereby lead to the allocation of necessary resources to data-gathering organizations. To arrive at this stage will necessarily involve an appraisal of the technical and political issues related to data management and dissemination.

Climatological data

11. Climatological data management is generally well developed, with programmes such as the National Oceanic and Atmospheric Administration (NOAA) Climate Computing (CLICOM) constituting an unofficial international standard. An important aspect of the CLICOM programme is connected with the adoption of a commercially available database (Dataease) with which climatological applications are constructed. The National Oceanic and Atmospheric Administration is therefore not itself responsible for the code; this remains the responsibility of a commercial company that offers quality assurance, technical support and upgrades.

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Hydrologic data

12. Management of hydrologic and hydrogeologic data, on the other hand, is not so highly developed. Much hydrologic and hydrogeologic database compilation is project-oriented and rarely standardized. Moreover, much of the data have been and are being processed and managed in custom-built software packages developed for mainframe computers by hydrologic scientists and engineers (but rarely by formally trained software engineers), who are usually from research institutes. The initial training and maintenance costs for these packages are often high, with programme costs amounting to tens of thousands of dollars. Moreover, they do not reflect the inclusion of the thorough quality assurance procedures and upgrades that have become the norm in commercial software houses.

13. The proliferation of a wide range of these non-commercial and non-professional packages continues. Very few have standard means for transferring data other than standard American Standard Code for Information Interchange (ASCII) file transfers; therefore data will always lose structure and relationships when exported to other packages. The result is that much expensively acquired hydrologic data ends up in equally expensive and not always reliable electronic forms, often underused, underanalysed and rarely shared.

Physiographic and land-use data

14. To the extent that physiographic information and information on land use and land degradation are available, they need to be coupled with water resources data. Considerable interest has been shown by earth scientists and those concerned more generally with natural resources in the integration of remote sensing data and geographical information systems. There now exist several well-established companies that produce hardware and software systems to carry out precisely such integration. There are a number of United States- and Europe-funded satellites able to provide weather and atmospheric flow data in some areas to countries with a "down link". Those data provide some basic information even though they may not be totally accurate without ground truth. Remote sensing imagery is also useful for providing land-use and environmental data.

Digital imagery

15. For the most part, satellite sensing systems for earth science applications collect multi-temporal digital imagery that can be made available to the consumer on magnetic media in a preprocessed format, that is, a corrected and geometrically rectified one. The data can be further processed interactively to aid interpretation through the use of image processing software and high-resolution monitors. In the past this imagery has been interpreted manually by using a series of acetate overlays and scribed masks to compile conventionally printed cartographic products. More recently, the ability to interpret the raster imagery directly on high-resolution monitors and store the electronically traced lines, points and polygons as vector overlays for input into geographical information systems has been developed on personal computer-based systems. As costs of computing power and memory continue to be reduced, the application of that ability becomes progressively cheaper and, in theory, more cost-effective.

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16. Multi-temporal satellite data can provide relatively cheap synoptic views of these resources, and geographical information systems can furnish the ability to quantify and analyse the nature of the distributions. It is important to bear in mind, however, that raw satellite data are inaccurate. The atmosphere between the satellite sensors and the reflective surface of the Earth is hundreds of kilometres (km) thick and contains continuously variable amounts of condensed water, atmospheric gases and dust. There is significant atmospheric attenuation and scattering of both incident and reflected radiation. Consequently the measured spectral response of the Earth's surface to sunlight at an altitude of 914 km (in the case of Landsat satellites) is very different from that of a spectrometer held a few metres above the same surface at the same time. Not surprisingly, the raw satellite data need to be corrected and rectified before they are ready for interpretation. The suppliers of most remote sensing data will carry out standard image restoration to compensate for data errors, noise, geometric distortion and atmospheric effects. The objective is to make the image resemble that produced by human perception of the original scanned scene. A commercially available satellite image thus becomes an observation to which a largely unquantifiable level of error is attached. The degree, then, to which any preprocessed image can be regarded as an objective record of the state of the Earth's surface at a particular time is clearly limited.

Socio-economic data

17. To the extent that socio-economic data are available they are seldom related to water resources, and even less so in terms of spatial relationships as related to watersheds or groundwater basins. The situation is particularly serious in terms of water-demand data and water-use patterns, especially in a number of countries that are known to be critically water-short, or close to becoming so. The collection, processing and analysis of water-demand and water-use data on a location-specific basis need to be given priority consideration in many developing countries, particularly those located in water-scarce regions.

Geographical information systems

18. From a technological point of view, the decade of the 1980s witnessed a rapid evolution in the field of electronic data processing to the point where the hardware and software required for integrated data management have now become widely available at relatively low cost. There are currently a variety of computerized geographical information systems (GIS) that facilitate the storage and processing of spatial information. There is clearly a need to develop geographical information systems for natural resource monitoring and evaluation. Natural resources are distributed in space and in time, and multi-temporal satellite data can provide relatively cheap synoptic views of those resources. Geographical information systems can furnish the ability to quantify and analyse the nature of the distributions. It is important, however, to temper this realization with an appreciation of the inherent limitations of the data and analysis systems, and of the need for support in digital cartography. The database structure needs to be considered carefully and note taken of the fact that conventional database languages such as structured query language (SQL) may not necessarily be suited to spatial queries. The original mapping base needs to be digitized, and points, lines

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and polygons stored as vectors consume a significant amount of computer memory. The work of digitizing is time-consuming but must be meticulously executed if it is to be worthwhile; coordinate transformations of data need to be carried out to ensure conformity of data derived from other digitized projections; and physiographic boundaries need to be matched with administrative and political ones. Given the above-mentioned considerations, it is important, prior to any investment in such systems, to determine that the objectives of the projects to be executed are indeed based upon a clear understanding of the data and the systems. Failure to so proceed will result in a raising of the expectations of project executors and consumers beyond a level commensurate with technical feasibility.

B. Proposals for enhancing capacity-building at the national level

19. The United Nations is in the process of formulating a capacity-building programme aimed at assisting Governments in the management of information for water resources management. This is being initiated with a view to optimizing economic and social development, while ensuring environmental sustainability. The programme would be implemented in cooperation with the United Nations Development Programme (UNDP) and the various organizations of the United Nations system. Although global in concept, it could be implemented at the national level by means of replicable pilot studies.

20. A feasibility study on developing multi-system interfaces to interconnect state-of-the-art expert or geographical information systems with existing conventional databases was initiated by the Department of Economic and Social Development of the United Nations Secretariat in 1992. The study may lead to the design of interface systems that could enable national planning authorities to make the best use of both modern technology, including decision-making tools like expert systems, and a variety of individual databases on different systems. It is expected that the feasibility study will be completed in the latter part of 1993.

21. Following the completion of this study, it is envisaged that a preparatory assistance phase will be initiated during which a prototype multi-system interface would be field-tested through a pilot programme carried out in a few countries. Subsequently, a capacity-building programme - in which information needs and existing databases would be surveyed, tailor-made information systems designed and the appropriate computer hardware and software, including the necessary interface system, determined - would be designed and implemented at the country level. Institutional constraints related to information management would be examined with a view to strengthening technical capacities where needed, and improving horizontal and vertical institutional integration. Training of staff in the use of economic water planning models would be provided.

22. Upon completion of the preparatory assistance phase of the programme and a refining of the procedures, the convening of a conference of national experts and external support agencies is envisaged, aimed at building a consensus on this approach to capacity-building in the field of information management based on the experience gained during the initial phase. Following the agreement of

all parties to the further development of the programme and to its design, it is anticipated that a number of initiatives could be set in motion and financed either separately or under a umbrella-type trust fund programme.

III. INFORMATION MANAGEMENT AT REGIONAL AND GLOBAL LEVELS

23. The monitoring of progress achieved in the implementation of the Mar del Plata Action Plan and of issues concerning the development, management and utilization of water resources has been a central focus of the activities of the Committee on Natural Resources and of the General Assembly during the 1980s. These monitoring activities of the organizations of the United Nations system in response to the requirements of intergovernmental bodies led to the preparation of regional surveys concerning the implementation of the Action Plan, the preparation of a strategy for its implementation in the 1990s, 7/ and the preparation of the report of the Economic and Social Council (A/45/327) to the General Assembly on the achievements of the International Drinking-Water Supply and Sanitation Decade (1981-1990). In addition, individual organizations have reported to their intergovernmental governing bodies on specific issues pertaining to their own fields of endeavour.

24. At the present time, the monitoring of water resources-related issues takes on an added dimension and sense of urgency in the light of Agenda 21. If an adequate follow-up of the Mar del Plata Action Plan into the 1990s, and of the provisions of Agenda 21 concerning freshwater resources, is to take place, the relevant intergovernmental bodies will require periodic analytical reports on the state of the freshwater resources of the world.

25. The experience of the 1980s with regard to the monitoring of progress in the implementation of the Mar del Plata Action Plan has demonstrated that the information put together for reporting purposes was, for the most part, inadequate and superficial, particularly concerning what appear to be the main issues. The available information did not lend itself to processing in a manner sufficiently comprehensive to generate more specific analyses for identifying or anticipating problems affecting or likely to affect given locations. More important, that information did not provide the tools for achieving an understanding of the interrelationship of important variables affecting the sustainable development and utilization of water resources, nor did it satisfy the need to provide the intergovernmental process with information suitable for identifying priority areas for action, and bringing about an effective process of policy formulation at national, regional and global levels.

26. Even though there is a serious lack of data in some areas, such as those of water demand and of water-use patterns on a location-specific basis, as well as of information concerning the location and size of hydroelectric plants, a number of data-gathering programmes exist within and outside the United Nations system. Many have performed invaluable services within their specific fields, and others are undergoing continuous growth. Some of those programmes (to mention a few) are listed below:

Water and Sanitation Monitoring System (WASAMS), United Nations Children's Fund (UNICEF)/World Health Organization (WHO)

Environmental Health Management Information System (EHMSYS), WHO

Global Resource Information Database (GRID), United Nations Environment Programme (UNEP)

Global Environmental Monitoring System/water-quality data (GEMS/WATER), WHO/UNEP

Global Run-off Data Centre (GRDC), World Meteorological Organization (WMO)

Hydrological Information Referral Service database (INFOHYDRO), WMO

CLICOM and World Climate Data Information Referral Service (INFOCLIMA) databases, WMO

Africa Real Time Environmental Monitoring using Imaging Satellites programme (ARTEMIS), Food and Agriculture Organization of the United Nations (FAO)

Demographic, economic and social indicators, United Nations, World Bank

Health indicators, WHO

27. Information is also available in various organizations, including the regional commissions, concerning institutional arrangements as they relate to water resources among national or regional river basin organizations. This information has not, however, been compiled in a systematic database. Information concerning agreements on shared river basins has been collected by FAO and the Department of Economic and Social Development of the United Nations Secretariat, which is in the early stages of developing a computerized database in this area.

28. National and local information is also being gathered and analysed by national authorities in many developing countries, often with the support of external support agencies, although dissemination and exchange of these valuable data are inadequate or non-existent. Some examples of these national or local programmes, to mention only a few in the critical region of Africa, are given below:

(a) The Programme for Water, Soil, Fertilization, Irrigation and the Mechanization of Agriculture (ESFIMA), carried out under the aegis of the Ministry of Higher Education and Research of Burkina Faso, which is aimed at the control of desertification through the study of soil erosion, and of the relationships between water, soil and plants, and chemical, organic and biological fertilization;

(b) The Earth Resources Survey Project (PIRT), established by an agreement between the Government of Mali, the United States Agency for International Development, and the Aid and Cooperation Fund of France, which is overseen by the Ministry of Environment and Livestock of Mali. Its initial objectives were to survey the natural resources of Mali on the basis of Landsat images, and to train local staff;

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(c) The Project for the Mapping and Remote Sensing of the Resources of the Republic of Senegal, carried out by the Department of Land Development of Senegal, with the financial and technical assistance of the United States Agency for International Development, whose aim was to produce maps from Landsat images interpreted visually for various themes, including vegetative cover, hydrogeology and land use;

(d) The Multidisciplinary Working Group for the agro-hydrometeorological monitoring of the agricultural season in the Niger, which was set up under the aegis of the WMO AGRHYMET (Agrometeorology and operational hydrology and their applications) Regional Centre in Niamey, and is overseen by the Director of the National Meteorological Department of the Niger;

(e) The Project for the Dynamic Mapping of Desertification in the Menzel Habib Region of Tunisia, conducted by the National Remote Sensing Centre of Tunisia, with the assistance of a French remote sensing user group and the Tunisian Ministries of Agriculture and Defence, whose main objective is to use dynamic mapping to monitor environmental changes;

(f) The Remote Sensing Programme, carried out by the Soil and Water Research Institute of Egypt with the support of the Canadian International Development Association (CIDA) and McGill University in Canada, which interprets Landsat and Experimental Earth Observation Satellite (France) (SPOT) satellite data in order to provide support to the Institute's activities, such as soil mapping, and land-use and water resources management;

(g) The Integrated Programme on Arid Lands, carried out by the University of Nairobi in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Government of Switzerland, which involves the use of remote sensing based on Landsat and SPOT satellite images;

(h) The National Meteorological Service Agency of Ethiopia, formerly under the National Water Resources Commission, which studies and supplies information on the country's climate with a view to understanding the meteorological systems that affect the country.

29. The Administrative Committee on Coordination (ACC) Intersecretariat Group for Water Resources, at its thirteenth session held in October 1992, recognized that while existing programmes were very useful in terms of the specific purpose for which they had been designed, they did not provide a system capable of synthesizing the data into an organic whole with a view to determining gaps in knowledge, analysing existing data in order to determine risks levels of specific areas and formulating strategies for further information-gathering. The members of the Group agreed that in spite of the data available in various databases, the capability to make a meaningful assessment of the state of the world's freshwater resources did not exist at the present time. The members of the Group agreed on the importance of establishing a system capable of integrating available information concerning various aspects of water resources development and utilization. The Group expressed its awareness of the complexities involved in developing an integrated database system, and of the fact that it would require the commitment of financial resources. Consequently, the participants stressed the need to proceed in a gradual and incremental manner, with well-defined objectives. Such a system should be

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flexible and demand-driven at all times, in order to ensure its relevance to the needs of the international community.

30. The members of the Group agreed on the importance of establishing a suitable methodology for carrying out work in the area discussed above, in order to define its focus and ensure its relevance. They agreed to consider at the next session of the Group measures that should be taken towards the possible establishment of a system-wide integrated monitoring and assessment network. They also envisaged the possibility of convening an expert consultation at a later stage. Consequently, a working group of the ACC Intersecretariat Group for Water Resources, under the chairmanship of WMO, and composed of the United Nations, UNEP, UNICEF, UNESCO, FAO, WHO, the World Bank and WMO, was entrusted with the task of identifying both existing relevant databases for the purpose of defining the issues involved in integrating their data (including such questions as that concerning the division of databases among those concerned with the resource itself, and those dealing with its use), and the various elements that should be considered in defining the basic methodology for the system, such as health, economic indicators, land-use indicators, food production and population, as well as the ways in which those elements should be classified and managed. The working group, which is scheduled to meet in June 1993, will consider the steps to be taken in the preparatory phases of the process concerning methodological approaches, including estimates of the financial resources that might be required in setting up the system.

Notes

1/ See Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977 (United Nations publication, Sales No. E.77.II.A.12), chap. I, paras. 41 and 44 (d).

2/ See Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (A/CONF.151/26/Rev.1), chap. 18, para. 18.6.

3/ Ibid., para. 18.12 (b).

4/ Ibid., para. 18.12 (c).

5/ Ibid., chap. 40, para. 40.3.

6/ Ibid., para. 40.5 (b).

7/ See document E/C.7/1991/8, sect. III.

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CROSS-SECTORAL PRIORITY PROGRAMMES FOR COORDINATED ACTION BY THE UNITED NATIONS SYSTEM IN THE AREA OF WATER RESOURCES: CAPACITY-BUILDING FOR WATER RESOURCES MANAGEMENT

Report of the Secretary-General

SUMMARY

Building the capacity for integrated water-resources development and management was highlighted by the International Conference on Water and the Environment, held at Dublin from 26 to 31 January 1992, as an area for priority action.

The United Nations Conference on Environment and Development, held at Rio de Janeiro in June 1992, also contains many references to national capacity-building initiatives.

The present report reviews what is commonly meant by the term capacity-building and what might constitute the elements of a capacity-building strategy for integrated water resources development and management. It describes a method of proceeding from water sector assessments through the formulation of national water resources strategies to the elaboration of action plans as the best way in which natural capacity-building can be accelerated in developing countries.

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* E/C.7/1993/1.

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I. EVOLUTION OF THE CONCEPT OF CAPACITY-BUILDING

1. The present report deals with capacity-building components of integrated water resources development and management that have been highlighted in both past initiatives and recent expert and intergovernmental meetings with a view to drawing to the attention of the Committee on Natural Resources the urgent need to address the issue of the means of implementing the measures recommended. Broadly speaking, the concept of capacity-building is one that has evolved through time and refers to programmes designed to enhance national capacity to develop and manage water resources.

2. At the United Nations Water Conference which took place at Mar del Plata, Argentina, in 1977, national capacity-building was not addressed as such, although many of the components that are now included in the usual definition of the term were mentioned individually. For example, reference was made to strengthening institutions, remedying manpower shortages and providing appropriate and cost-effective technology.

3. In the specific regional recommendations for Africa of the Mar Del Plata Action Plan, institutional inadequacy was recognized to have been one of the major constraints on the effective development of water resources. 1/ In the Action Programme on Water for Agriculture, specific reference was made to building up of national advisory services; training, extension, research and strengthening of formal education; and establishment and improvement of institutions for management, administration and legislative support. 2/ Under the section on public information, education, training and research, it was stated that many countries shared problems in educating, training and retaining properly qualified and experienced personnel at all professional and subprofessional levels. 3/

4. By 1991, in the report of the Secretary-General (E/C.7/1991/8) on strategies and measures for the implementation of the Mar del Plata Action Plan in the 1990s, which was presented to the Committee on Natural Resources at its twelfth session, institutional weaknesses were again recognized to be a major factor retarding progress and, furthermore, the fragmentation of responsibilities for water resources development and management was also seen as a contributory factor. In paragraph 72 of that report, seven issues were identified as urgent and calling for priority within a national water strategy for the 1990s; with respect to one of those issues, it was declared that to enhance the capacity for the development and management of water-related programmes, greater efforts had to be made to strengthen institutions and develop human resources at all levels.

5. In the above-mentioned report, the view was expressed that increasing the financial resources to the sector was a necessary but not a sufficient condition for progress to be made. Many countries had lost the ability to absorb external funds owing to the near breakdown of public sector institutions during the 1980s.

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6. It follows that creating an enabling environment for sustainable progress is clearly a much wider issue than one involving just institutional reform and training. It involves the whole debt problem, coping with structural adjustment, social equity, political change and a new awareness of the importance of environmental concerns.

7. At the United Nations Development Programme (UNDP) Symposium: A Strategy for Water Resources Capacity-Building, held at Delft, The Netherlands, from 3 to 5 June 1991, a first articulation of what could contribute to national capacity-building was attempted. To a certain extent, the term was expanded to include a number of additional elements such as privatization; on the other hand, it was narrowed to exclude macroeconomic externalities and concentrate on three basic elements: 4/

(a) An enabling environment with appropriate policy and legal frameworks;

(b) Institutional development and community participation;

(c) Human resources development.

8. By this time also, capacity-building had been readily accepted into the vocabulary of bodies such as the UNDP Governing Council through the concept indicating that an increased focus on human development would broaden the basis for national capacity-building. The Governing Council had requested that proposals be made by the Administrator for designing indicators to assess progress in the strengthening of national capacity for self-reliant development. 5/

9. The International Conference on Water and the Environment, held at Dublin from 26 to 31 January 1991, was part of the preparatory process for the United Nations Conference on Environment and Development, held at Rio de Janeiro in June 1992. The Dublin Conference called for major new approaches to the assessment, development and management of freshwater resources and, in the Dublin Statement, 6/ highlighted both creating the enabling environment and building the capacity for integrated water resources management.

10. In five of the six major working group sessions, the issue of capacity-building was addressed specifically and recommendations were incorporated in the Report of the Conference. This body of information provides some of the most up-to-date assessments of what needs to be done to accelerate progress towards sustainable water resources development and management. A minor change from the Delft Declaration was made, however: community participation was not always perceived as part of an institutional development strategy, and was thus treated as a separate (fourth) element.

11. The response from external support agencies to the United Nations Conference on Environment and Development concerning the provision of additional concessional financing for the implementation of its many recommendations fell short of perceived needs, and in general freshwater issues were eclipsed by the debate between North and South over environment

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and development and by such global issues as ozone layer depletion, global warming, degradation of tropical forests and biodiversity. Chapter 18 of Agenda 21, 7/ concerning freshwater, contains what remains the consensus position on action to be taken with regard to the rational utilization and conservation of freshwater resources at national, regional and global levels. A description of the main activities is given in the report of the Secretary-General (E/C.7/1993/5), to the Committee on Natural Resources, on provisions of Agenda 21 relevant to the area of freshwater resources.

II. DEFINITION OF CAPACITY-BUILDING

12. At present, UNDP has launched a programme in support of Agenda 21 entitled Capacity 21. The objectives of that programme are to assist developing countries in formulating development goals, plans and programmes that lead to sustainable development in economic, social and environmental terms. In addition, the programme is designed to enhance the capacity of developing countries to continue to formulate and implement their own sustainable development policies.

13. The activities of this programme will be based on the relevant provisions of Agenda 21 in the field of capacity-building. However, by itself this broad description does not allow of an analytical approach to the formulation of a specific action programme for water resources.

14. A working definition of national capacity for self-reliant development for the purpose of measurement was set down earlier in the above-mentioned report on the role of UNDP in the 1990s. It was recognized therein that six interacting dimensions, embracing economic, social, institutional, technological, political and human resource components, produce the enabling environment for promoting the goals of production and efficiency. It could be argued that social equity and environmental sustainability would normally be added to those goals to reflect current world-wide opinion.

15. Each of those dimensions may be said to be relevant to water resources development and management with the proviso that, at the technical level, the political dimension should be limited pragmatically to the following elements: the establishment of a national water resources policy, the recognition of the importance of water resources development for economic and social progress and, in the case of international water bodies, the need to consult with other riparians on the use of those resources.

16. During the International Conference on Water and the Environment, the working group on integrated water resources development and management considered seven major components that could be correlated with the UNDP dimensions of capacity-building, as shown below.

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Dublin Conference components	UNDP dimensions
Integrated planning	Political
Demand management	Economic
Institutional arrangements	Institutional
Legal frameworks	
Public participation	Social
Effective technologies	Technological
Human resources	

17. If it is accepted that planning can be broadly defined as the putting of policy into practice, there is a striking similarity between the Dublin Conference components and the UNDP dimensions. The need for training and human resources development was seen as a common thread throughout the discussion by the working group of the Dublin Conference components, and the chapter of the Conference Report dealing with integrated water resources development and management emphasizes this fact by containing a section on capacity-building 8/ divided in the following manner:

Information base and know-how

Human resources development

Public awareness

Institutional and legal arrangements

18. Planning, demand management, finance and investment were also regarded as important elements of implementation.

19. The other chapters of the Report deal variously with capacity-building and human resources development in ways reflecting the different approaches of the working groups to their subjects. However, the four essential elements listed above are reflected throughout the report.

20. In chapter 18 of Agenda 21, mention of capacity-building elements, as defined above, is scattered throughout the presentation of the seven programme areas under the heading either of activities or of means of implementation. This reflects the interrelationships between the basic structures of the Report of the Dublin Conference and those of chapter 18 of Agenda 21. Table 1 gives information on the specific paragraphs of Agenda 21 that contain references to capacity-building activities and table 2 presents the relevant paragraphs dealing with capacity-building objectives.

21. The concept of capacity-building has thus evolved and been enhanced over a range of global development and environmental initiatives. The degree to which a commonly accepted definition can be articulated is clearly limited but as far as water resource development and management are concerned, a working definition could be based on the Dublin approach. Through this approach, capacity-building would be defined in terms of four elements: (a) information development and management, (b) human resource development, (c) institutional and legal arrangements and (d) public awareness.

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Table 1. Main capacity-building activities mentioned in chapter 18 of Agenda 21 (Relevant paragraph)

Broad group of proposed activities	Programme area A	Programme area B	Programme area C	Programme area D	Programme area E	Programme area F	Programme area G
Application and transfer of technology	18.12 (i) 18.14 18.20 (f)	18.25 (a) 18.30	18.42 18.43		18.61	18.79 18.81 (f)	
Strengthening of information management	18.12 (c) 18.14 18.20 (f)	18.25 (d) 18.27 (b)	18.40 (g) (ii) 18.44	18.50 (d) (i) 18.50 (d) (ii)		18.76 (h) (v)	
Promotion of public participation in water management	18.9 (c) 18.12 (n) 18.19	18.34 (d)		18.50 (b) (iii) 18.50 (c) (ii) 18.54	18.59 (c) (iii) 18.59 (f) (iv) 18.62	18.68 (d) 18.72	
Human resources development	18.19 18.20	18.31 18.32 18.33	18.38 (c) 18.45 18.46	18.50 (b) (iv) 18.53	18.59 (e) (iv) 18.62	18.79 18.80 18.81 (e)	18.89
Strengthening of institutional and legal mechanisms	18.12 (o) (ii) 18.21 18.22	18.25 (d) 18.27 (a) (ii) 18.34 (a)	18.40 (e) (i) 18.40 (e) (v) 18.47	18.55	18.59 (c) 18.59 (e) (i) 18.63	18.76 (a) (vi) 18.81	18.90
Strengthening of local water resources management	18.12 (m) 18.12 (o) (i) 18.22	18.34 (d)		18.50 (b) 18.50 (c) 18.54	18.59 (c) 18.59 (f) (i) 18.59 (f) (v)	18.76 (a) (iv) 18.76 (b) (iv) 18.76 (e)	
Strengthening of national water resources management	18.12 (a) 18.12 (o) (ii) 18.22	18.25 (b) 18.27 (a) (i) 18.27 (a) (iii)	18.40 (a) (iii) 18.42 18.43	18.50 (b) (i) 18.50 (c) (iii) 18.50 (c) (iv)	18.59 (e) (ii) 18.64	18.76 (a) (i) 18.76 (a) (vi) 18.76 (h) (i)	18.90
Strengthening of water basin resources management	18.9 18.10 18.12 (o) (iii)	18.27 (a) (iv)	18.36 18.40 (h) (i) 18.40 (h) (iii)				

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Table 2. Main capacity-building objectives as set forth in chapter 18 of Agenda 21

Objective	Supporting citation
Integrated planning	"The widespread scarcity, gradual destruction and aggravated pollution of freshwater resources in many world regions, along with the progressive encroachment of incompatible activities, demand integrated water resources planning and management. Such integration must cover all types of interrelated freshwater bodies, including both surface water and groundwater, and duly consider water quantity and quality aspects. The multisectoral nature of water resources development in the context of socio-economic development must be recognized, as well as the multi-interest utilization of water resources for water-supply and sanitation, agriculture, industry, urban development, hydropower generation, inland fisheries, transportation, recreation, low and flat lands management and other activities" (para. 18.3) "Promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socio-economic, environmental and human health considerations" (para. 18.9 (a)) "To plan for the sustainable and rational utilization, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy" (para. 18.9 (b)) "Ensuring the assessment and forecasting of the quantity and quality of water resources, in order to estimate the total quantity of water resources available and their future supply potential, to determine their current quality status, to predict possible conflicts between supply and demand and to provide a scientific database for rational water resources utilization" (para. 18.24)

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Table 2 (continued)

Objective	Supporting citation
	"Long-term development of global freshwater requires holistic management of resources and a recognition of the interconnectedness of the elements related to freshwater and freshwater quality" including "the intrinsic linkage between water resource development projects and their significant physical, chemical, biological, health and socio-economic repercussions". Similarly, "erosion, sedimentation, deforestation and desertification have led to increased land degradation, and the creation of reservoirs has, in some cases, resulted in adverse effects on ecosystems" (paras. 18.35 and 18.36) "Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour" (para. 18.48 (b))
Demand management	"Rational water utilization schemes for the development of surface and underground water-supply sources and other potential sources have to be supported by concurrent water conservation and wastage minimization measures" (para. 18.3). "In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged appropriately" (para. 18.8)
Institutional and legal arrangements	"To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth" (para. 18.9 (d)). "Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour" (para. 18.48 (b))
Public participation and awareness	"To design, implement and evaluate projects and programmes that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth, indigenous people and local communities in water management policy-making and decision-making" (para. 18.9 (c))

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Table 2 (continued)

Objective	Supporting citation
	"Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes", "and the full participation of women at all levels in sector institutions" (para. 18.48 (b) and (c))
Effective technologies	"Innovative technologies, including the improvement of indigenous technologies, are needed to fully utilize limited water resources and to safeguard those resources against pollution" (para. 18.2). "To make available to all countries water resources assessment technology that is appropriate to their needs, irrespective of their level of development, including methods for the impact assessment of climate change on freshwaters" (para. 18.25 (a)). "Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies" (para. 18.48 (d))
Human resources development	"To have sufficient numbers of appropriately qualified and capable staff recruited and retained by water resources assessment agencies and provided with the training and retraining they will need to carry out their responsibilities successfully" (para. 18.25 (e))
Information base and know-how	"To have all countries, according to their financial means, allocate to water resources assessment financial resources in line with the economic and social needs for water resources data" (para. 18.25 (b)) "To ensure that the assessment information is fully utilized in the development of water management policies" (para. 18.25 (c))

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III. ELEMENTS OF A CAPACITY-BUILDING STRATEGY

22. Once this definition is accepted, the issue then becomes one of implementation, particularly in the context of the generally fragmented water sectors of many developing countries. The following sections of this report will attempt to develop a practical strategy for capacity-building given the severe constraints and many competing demands on financial resources. Proposed herein is a three-stage methodology that considers how water sector assessments allow of the articulation of development strategies and the formulation and implementation of action plans for capacity-building.

A. Water sector assessments

23. The starting-point of any capacity-building programme at the national level will clearly be a needs assessment. This should be carried out preferably as part of the formulation of a national economic development strategy but not in such a way as to delay progress while other economic and social sectors are being appraised. Instead what is intended is that the interrelationships between the water resources sector and other sectors should always be taken into account and that priorities should stem from stated government policy. In the case where, from an expert point of view, water resources have been dealt with inadequately in national development plans, the water sector assessment allows of an opportunity to raise issues dealing with the benefits of, and the consequences of not, taking action with government in an attempt to readjust priorities.

24. Central planning, and even national development planning, is becoming increasingly less common as greater use is being made of the private sector, as water is being regarded as an economic good and as the prevalence of market-place economics mitigates against the subsidizing of public sector institutions. The absence of a national development plan may make it more difficult to relate the objectives and goals of a water resources strategy to national policy. The high level of social environmental and economic benefits from water programmes, however, should make it possible to justify priority's being given to the water resources sector as a stand-alone exercise.

25. In cases like these and in particular in the countries in transition to a free-market economy, a needs assessment for capacity-building is of vital importance, particularly in the areas of institutional and legal arrangements to manage the transition, to establish government safeguards to protect freshwater resources and to introduce new, dynamic macroeconomic-based multiple-objective water planning techniques.

26. The sector assessments may range from very comprehensive and detailed needs assessments to much more focused and specific reviews of priority capacity-building components.

27. The concept of a rapid assessment, which was developed by the former Department of Technical Cooperation for Development of the United Nations Secretariat and incorporated into the main background documents for the UNDP Symposium at Delft, was intended to provide a mechanism whereby Governments could take stock of their current situation, engage in a policy dialogue, decide where they wanted to be in five years time and articulate the main elements of a programme to attain specific objectives in a limited time-period within available resources.

28. On the basis of wide field experience, the former Department of Technical Cooperation for Development accepted the fact that a more comprehensive approach, akin to the water resources master planning of the 1960s and 1970s, would take a number of years to complete and, in addition, rarely dealt adequately with the problems of priority and available financial resources. While the lengthy resource inventory part of the master planning exercise was worthwhile, it tended to detract from the strategic planning part which was of most use to decision-makers. Unless the master planning team was able to enter into a realistic dialogue with government decision-makers over priorities and resources, the articulation of potential programmes and projects stood in danger of becoming an empty exercise. To test the concept, and as part of its regular programme of technical cooperation, the former Department of Technical Cooperation for Development of the United Nations Secretariat carried out two water sector reviews in cooperation with UNDP in Morocco and Yemen. Both reviews were of limited duration and constituted rapid sector assessments rather than comprehensive water assessments.

B. Development strategies

29. Whatever approach to water resources sector assessments is adopted, the undertaking of such assessments may be regarded as constituting the diagnostic phase, during which the major issues and their capacity-building requirements can be identified. During this phase an essential dialogue must be established between and among the major actors in the sector. If a sector assessment is to be successful, it must draw upon as wide a range of experience, expertise and inside knowledge as possible. This is the only way to accelerate the consensus-building process by prior identification of the principal problems, potentials and constraints to development.

30. From the dialogue, which may be as extensive as a national conference or referendum (should circumstances dictate that the most democratic processes ought to be used to determine priorities), a strategy evolves to deal with the priority issues identified in keeping with government policy and the resources available.

31. The specific programme of action, once agreed upon, will determine the phasing of activities within the planning period. From a practical point of view, usually this cannot be longer than five years, although a longer-term perspective must be included because of the long lead-times required to complete irrigation, water-supply and multiple-purpose schemes. Decisions

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have to be taken at this stage on whether the achievable targets are consistent with overall government policy objectives and with the expectations of the electorate. If not, an opportunity is provided to adjust budgetary allocations should an increase in the scope or pace of water resources development, and in the speed of implementation, be required.

32. The process is interactive, therefore, in the sense that it involves work both with policy makers and with stakeholders (the recipients of development). It is also dynamic in that it uses much shorter time-frames, involves more limited objectives and allows adjustments to be made.

33. The strategic options to be considered will usually focus on the various means of matching supply with demand, particularly in water-short situations. Large urban areas, with rapidly increasing populations and services stretched to their limit, often require the most urgent attention but, as with the drought-prone areas of Africa, neglect of water and food security in the rural areas can be disastrous. In many other countries, an increasing threat to water resources comes from pollution due to domestic, industrial or agricultural contamination. Water-quality problems are often extremely intractable and expensive to remedy.

34. Providing technical solutions to these issues may require a degree of lateral thinking with regard to seeking innovative approaches or new techniques such as macroeconomic-based multiple-objective water resources planning models. In all cases, the full participation of national professionals in developing the solutions offers a better chance not only of attaining sustainable results but also of leaving in place teams equipped with improved skills to face new problems as they arise.

35. There is probably no single area where capacity-building and skill enhancement are needed more than in the field of water resources strategy formulation. New techniques for demand management, resources assessment, modelling and information management make this work much easier than it was in the past, and also allow for more effective communications with decision makers. There is an urgent need, however, to train and equip water planning teams in developing countries in the practical application of those techniques to individual country situations.

36. Finally, strategic options may well include the strengthening of institutional and legal frameworks to provide a better basis for the integrated development and management of resources. This will involve the whole range of stakeholders, professional associations and public sector institutions. To ensure the fullest possible public participation in the water resources development and management process, new institutional mechanisms may well have to be put in place, incorporating the concept of managing water resources at the lowest appropriate level. The formal modification of the legal instruments to bring this about provides the last link in the chain of capacity-building, although in many circumstances positive action may well have to await enactment of those legal instruments.

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C. Means of implementation

37. Once a consensus is obtained on the way forward towards improved water resources management and a strategy articulated to bring the necessary changes about, the programmed activities will be phased to fit the available human and financial resources, including external assistance. This constitutes the action plan, that is, a schedule of implementation determined by the financial flow and optimum management of human resources.

38. With regard to financial resources, although additional financing of the water resources sector is still subject to competing demands from other sectors, it may now be easier to obtain funds for capacity-building initiatives, given the current emphasis on national execution of technical cooperation programmes.

IV. A GLOBAL PROGRAMME FOR CAPACITY-BUILDING

39. Contrary to some expectations, the demand for technical cooperation has increased rather than diminished, but for very different types of assistance. As national capacities grow, countries (helped by gatherings like the International Conference on Water and the Environment, where the process of consensus-building encourages a wide exchange of views on current issues) are in a better position to define precisely what they need in terms of external assistance.

40. In countries where people trained in the required skills are in short supply, recourse is often had to using foreign nationals to carry out part of the development activities. This has been a common pattern over the past 40 years and has begun only recently to change significantly, as national capacities increase.

41. Criticism of external technical assistance is common for a variety of reasons. Often foreign nationals have insufficient knowledge of local conditions and make errors of judgement. Teams of expatriates do not always mix well with local counterparts and the opportunity to train by involvement is therefore lost. The interests of foreign-owned companies may not necessarily coincide with those of the host Governments so that discrete, time-limited projects will not always be able to achieve sustainable capacity-building. In addition the technology transferred from highly industrialized countries is not always the most appropriate for developing country situations and, most commonly, criticism is levelled at the generally high cost of external assistance.

42. On the other hand, if speed and efficiency of implementation are high priorities, there is often no alternative to supplementing local resources with outside assistance. Financing agencies set stringent conditions for loans and grants that will not be met where local capacities need reinforcing and appropriate skills are not available. They are often prepared to pay the higher price for external technical cooperation rather than commit themselves

to longer-term programmes that will involve expenditures in areas they consider to be the responsibility of recipient Governments. Since much of the financing may return to the donor countries in the way of payments for technical services or equipment, bilateral external assistance agencies do not necessarily see higher costs in the same way as developing countries. The latter feel that the same money can be made to go further if local skills and service are utilized. This does not take into account the conditions under which external aid is often made available by the donor nations and the guarantees of timely completion that are needed to satisfy external budgetary constraints.

43. From a pragmatic point of view, working compromises are usually found that, though satisfying neither of the opposing parties whose perspectives were sketched above, do ensure that the flow of external financing does not stop, although they inevitably fail to provide the optimum conditions for the growth of national capacities. Over the last 10 years, the pattern of technical cooperation has changed significantly, especially in relation to United Nations-sponsored activities. The emphasis has changed, moving from projects involving teams of international experts working in a manner almost independent of government institutions, to more interactive technology-transfer projects and programmes aimed at building national capacities and involving large training and fellowship components.

44. This meeting of minds and exchange of ideas constitutes the essence of modern technical cooperation, where external skills and wide experience are matched with a deep knowledge of national issues, local conditions and social, cultural or environmental constraints to development.

45. A good example of this approach is the UNDP-financed North China Water Management Project, which is being implemented in conjunction with the State Science and Technology Commission. (The Project is being executed by the Department of Economic and Social Development of the United Nations Secretariat.) The objective of the Project is to enhance the national capacity to manage water resources in an economically efficient and environmentally sustainable manner. The main vehicle for achieving that objective is training and technology sharing in the modern techniques of macroeconomic-based multiple-objective water resources planning, including the formulation of economic water planning models and their application to real problems in north China.

46. The external input to that Project comprises 16 individual consultancies in specific technical areas and two subcontracts for consultancy services in the field of industrial waste-water reuse and agricultural water-saving technologies. There are no resident expatriate personnel. Six regional centres have been equipped to undertake multiple-objective planning and modelling, including training by fellowships, study tours and on-the-job involvement of 95 professionals. The project is now well on the way to achieving its objectives, and it is enabling planning teams to tackle the problems of integrated water resources development and management in a water-scarce situation.

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47. A number of other projects in support of national capacity-building have also been undertaken by the Department of Economic and Social Development and UNDP. The first aimed at assisting the Government of Morocco in identifying and analysing the needs for technical cooperation in the water and sanitation sectors. 9/ It allowed the Government to assess how far the developments in the sectors had improved the standard of living of the population and preserved the ecological balance.

48. The mission took place in January 1991 and lasted one month. It comprised seven external experts together with a number of national consultants who were to play a catalytic role in the exercise by providing in-depth knowledge of local conditions.

49. The 17 recommendations of the mission were, for the most part, capacity-building ones - in areas including institutional and legal measures, training, information management (including geographical information systems) transfer of technology and community participation - except for those dealing with specific pilot projects, feasibility studies and analyses that were required to accelerate development in the water and sanitation sections. All these recommendations were accepted by the Government of Morocco and are in the course of being implemented.

50. A second rapid assessment was carried out in Yemen during the month of July 1991 and was in response to an urgent need to prepare an overview of the water sector. The main objective was seen as being the identification of the challenges being faced by the newly unified territories, which were in a period of transition, and the review of options for courses of action to be undertaken in response to those challenges. It was recognized that the northern governorates were abstracting water from aquifers at a rate that was twice that of their replenishment, and that there existed real dangers of mismanaging very limited and fragile resources.

51. The mission recommended that immediate legal action be taken to contain the uncontrolled drilling operations and to protect the water resource from overexploitation, quality degradation and irreversible damage. The second group of recommendations addressed the need to provide an appropriate legal and institutional framework whereby the proper allocation of water to sustain economic growth and satisfy society's needs for the resource could be established. These were judged to be the priority issues that would condition any future opportunity of attaining sustainable development in the sector. The dialogue with Government on these issues acted as a galvanizing catalyst to action that is still continuing at present.

52. A capacity-building exercise, albeit a very different one, is also being initiated in southern Africa in response to the recent drought. That exercise is being coordinated by the Department of Economic and Social Development of the United Nations Secretariat, UNDP and the United Nations Environment Programme (UNEP), in close cooperation with the Southern African Development Community (SADC).

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53. This region, comprising 11 countries, contains a number of major international river basins (for example, the Zambezi, the Limpopo, the Orange, the Kavango and the Cunene), the management of which will require cooperation among riparians. Long-term water and food security in the face of increasing demands and recurrent drought will therefore require regional cooperation to optimize utilization of shared resources and safeguard the future.

54. In this case, the capacity-building exercise is designed to reinforce existing institutions both in their ability to carry out integrated planning and management of water resources and in the adoption of compatible economic water management procedures, including those in the area of information management, to enhance regional cooperation.

55. In all participating countries, the starting-point for the process will be the rapid assessment of country situations. It is also proposed to strengthen the existing SADC Water Sector Coordinating Unit in support of regional capacity-building. The overall objective, however, remains the enhancement of national planning capacities as a fundamental step in supporting both national water development plans and international negotiations for joint use of shared water resources.

56. These three examples illustrate the way in which different national or regional situations dictate priorities and hence the focus of the rapid sector assessment. While it is essential for any approach to be as thorough as possible in addressing issues, the essence of this approach, it will be noted, involves the developing of a strategic framework in the short term to address agreed priorities. It assumes from the outset that funds will be limited and that this factor will force the making of choices among competing demands on resources. There is no reason why more detailed analyses cannot be carried out following the rapid assessment, including full-scale master plans, if these are deemed necessary.

57. Another approach is contained in the World Bank's proposal for a Water Resources Assistance Programme, to be financed by UNDP and executed in association with the United Nations. This is related to the development of a comprehensive water resources management policy for the World Bank and emphasizes the importance of a comprehensive water assessment as a first step in the assistance programme.

58. It is envisaged that the first phase of a comprehensive water assessment would last from three to six months, during which time an inventory of water resources, supply and demand on the resources, and physical and institutional infrastructure would be made. Key issues facing the sector could also be identified.

59. The second phase could concentrate on the development and evaluation of alternative strategies and is envisaged to last about six months depending on the size and complexity of the individual country. The first of these exercises is to be carried out in Tunisia, beginning in early 1993, in conjunction with UNDP and the Department of Economic and Social Development of the United Nations Secretariat.

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60. A number of countries in partnership with external agencies have attempted a compromise between full-scale master planning and comprehensive water assessments by limiting the planned action of a master plan to a small number of bankable projects. While this approach has merit in launching projects into which capacity-building activities can be incorporated, the criteria for determining the feasibility and financing of such projects are usually based on their economic internal rates of return. There are obvious limits to the scope and depth of any capacity-building elements because the benefits of these elements will be difficult to quantify and hence to include in the economic analysis of the selected projects.

61. It is argued that in the case of such projects, even a limited amount of training - institutional and legal reform and technology transfer, for example - is better than nothing, and this might be the case if there is no follow-up action after the preparation of a conventional master plan. On the other hand, participants at the Delft Symposium and the Dublin Conference recognized that a project-by-project approach could not ensure continuity and would ultimately lead to a situation involving non-sustainable capacity-building.

62. In adopting a global interregional capacity-building programme as a major area of concentration, there exists an obvious danger of spreading resources too thin even if the concept is narrowed down to the four components given above. At the same time, countries are very different in their development philosophies, priorities and level of achievement.

63. As a first premise, it is therefore suggested that the least developed countries, which usually stand in the greatest need of enhancing natural capacities, should be priority targets for support. However, since the willingness to address issues of capacity-building is the most important qualifying criterion for countries requesting assistance in this field, it is recognized that no country will be excluded from consideration on the grounds that it is not a least developed country although the implication from a global point of view of assigning priority to such countries is that Africa with its 30 least developed countries out of a total of 47 will be a priority region with respect to assistance.

64. Second, training components of projects and programmes must be seen not as an unavoidable inconvenience but as a fundamental part of the development process. In order to achieve this, the financial mechanisms for technical cooperation at the bilateral and multilateral levels need to be examined, in particular the balance between grant aid and loans. Given the long-term nature of capacity-building, it could be recommended that bilateral funding make an increased allocation to capacity-building programmes or at least that project-specific loans from development banks and multilateral lending agencies have a capacity-building component that extends beyond the life of the project. These recommendations should be supported even more vigorously given the general move away from a project to a programme approach.

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65. Assistance from developed countries must be programmed over a longer time-period than the normal project cycle in order to achieve sustainability. The application of the concept of the twinning of institutions has been found to be extremely effective in capacity-building since it ensures continuity and can embrace a wide range of skills and technologies. Successful twinning exercises have been carried out between parastatal or government institutions in developing countries and privatized river authorities, notably from the United Kingdom of Great Britain and Northern Ireland and France. This has also been seen as a useful first step in building national capacities to privatize public utilities.

66. Because of existing regional differences and the need to focus Governments' attention on the importance of capacity-building in the water resources sector, the greater involvement of the regional commissions may be considered to be an advantage in terms of creating a dialogue with Governments on policy implications.

V. CONCLUSIONS AND RECOMMENDATIONS

67. The optimum use of technical cooperation programmes, such as those described in the case-studies cited above, may be a major factor in accelerating national capacity-building. Its practical expression should logically begin with the building up of national strategic planning capabilities, because only in this way will feasible action plans that have a good chance of attracting financial support be put forward. (This is not to say that elements of the action plan should not concentrate on strengthening implementation capabilities, creating the opportunities for public participation, and involving community-based institutions, non-governmental organizations and women's groups.)

68. The use of the diagnosis-strategy-action plan methodology will help Governments in assigning priorities for action in a rational manner, based on perceived needs and available resources. The Committee on Natural Resources may therefore wish to consider recommending, to Governments that have not already taken such a step, the formulation of action programmes to implement the integrated development and management of their water resources at the earliest opportunity giving particular attention to capacity-building activities.

69. The Committee on National Resources may also wish to draw attention to the importance of capacity-building, carried out as either a separate programme or a component of all technical cooperation programmes, and in that case, the Committee may wish to consider how priority may be assigned to capacity-building with respect to the allocation of national, regional and global financial resources.

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Notes

1/ See *Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977* (United Nations publication, Sales No. E.77.II.A.12), chap. I, annex, para. 1.

2/ See ibid., chap. I, resolution III, containing the Action Programme on Water for Agriculture, para. 5 (d), (e) and (f).

3/ See ibid., chap. I, sect. F, para. 73.

4/ See *A Strategy for Water Sector Capacity Building*, International Institute for Hydraulic and Environmental Engineering (IHE) Report Series 24, G. J. Alaerts, T. L. Blair and F. J. A. Hartvelt, eds. (Delft, The Netherlands, and New York, IHE/UNDP, 1991), Delft Declaration, annex, para. 5.

5/ See document DP/1990/18 on the role of UNDP in the 1990s: indicators for national capacity-building.

6/ See *International Conference on Water and the Environment*: *Development issues for the 21st century, 26-31 January 1992, Dublin, Ireland*. *The Dublin Statement and Report of the Conference* (Geneva, World Meteorological Organization, 1992).

7/ See *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992*, vol. I, *Resolutions Adopted by the Conference* (A/CONF.151/26/Rev.1).

8/ See *International Conference on Water and the Environment*: *Development issues for the 21st century, 26-31 January 1992, Dublin, Ireland*. *The Dublin Statement and Report of the Conference* (Geneva, World Meteorological Organization, 1992), chap. 2, paras. 2.7-2.15.

9/ See PNUD (Programme des Nations Unies pour le Développment), *Analyse des besoins en coopération technique du secteur de l'eau et de l'assainissement au Royaume du Maroc: Rapport de la mission* (Rabat-Maroc, janvier 1991).

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FLOW OF FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY TO DEVELOP THE MINERAL RESOURCES OF DEVELOPING COUNTRIES

Ways and means of facilitating the flow of financial resources and transfer of technology to develop the mineral resources of developing countries

Report of the Secretary-General

SUMMARY

The mining sector in developing countries has historically been supported by multilateral, bilateral and private aid programmes and by foreign private investment commensurate with perception of country risk, competing project(s) economics, level of geological potential, information and development, and comfort with the long-term operating horizon.

Recently, an increasing number of developing countries have begun major restructuring programmes in the mineral sector and related areas in an effort to attract and facilitate the flow of private foreign capital. In varying degrees, mining legislation/regulation is in the process of being revised, the exploration and mine-permitting process is being streamlined and tax structuring and profit repatriation terms are being made more favourable. Efforts have also been made to undertake or upgrade geological surveys, make the existing geological data more accessible and train national staff in all skills required in mineral-resources development. Multilateral institutions have expanded programmes to facilitate the flow of financial resources from the private sector by offering extended non-commercial risk insurance coverage, investment-banking services, financing and guarantees, and foreign investment advisory services. Bilateral programmes have also been effective

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* E/C.7/1993/1.

in providing direct project funding, technical assistance and technology transfer.

Ways and means to further enhance the flow of financial resources and transfer of technology, as well as a description of programmes already in place and the recommendations of two related United Nations seminars, are provided in the present report. As funding through multilateral and bilateral agencies becomes increasingly restricted, it is expected that programmes that strengthen the flow of funds through private investment will be supported in a mutually beneficial manner.

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INTRODUCTION

1. This report has been prepared in response to Economic and Social Council resolution 1991/87. In recent years, a growing number of developing countries have initiated free market reform programmes in an effort to attract foreign investment and technology and revive economies stalled by decades of protectionist policies and excessive State intervention. In many countries, the revitalization and development of a significant minerals industry is seen as a way of contributing to the growth of the economic base by generating remunerative employment, income for the Government, much-needed foreign exchange; and spin-off benefits for the workforce and professionals from training in the techniques of exploration, mining, marketing and other related disciplines. In addition, increased revenues from the mining sector will assist social development programmes in public health, education and infrastructure.

2. Private, multilateral and bilateral aid programmes have played and will continue to play an important role in developing countries' progression towards economic independence. Foreign direct investments will also contribute significantly to economic independence as countries reposition themselves and become attractive places for foreign companies to invest. With this investment will come increasing access to state-of-the-art technology, training, enhanced management techniques and rehabilitation of outdated technology and infrastructure.

I. RECENT TRENDS IN PRICES, SUPPLY AND DEMAND OF METALS AND MINERALS

3. During the first half of the 1980s, as a result of the relatively slow growth of output in the industrial countries and high energy prices, metal prices steadily declined. As a result, the large stock overhang in the market exerted downward pressure on prices. This led in turn to substantial contractions in mining operations, with subsequent reductions in production capacity.

4. By 1987, stocks for virtually all metals had reached record lows and this set the stage for a sharp recovery in prices over the next two years. Large price increases were also associated with the sharp acceleration in the growth of industrial production in the major industrial countries. Industrial production grew at an annual rate of 1 per cent in 1986, 3 per cent in 1987 and 6 per cent in 1988. 1/ Responding to the rise in metals prices in 1988, some previously closed facilities were reactivated, existing capacity was substantially expanded and new smelting and refining plants were built.

5. The first quarter of 1989, however, marked the end of the boom in prices. The slow-down in world economic growth in 1989 and 1990, combined with increased metals production, led to price declines for a number of metals from 1988 levels and the mining industry continues to be caught in a prolonged cyclical downturn, with base metals particularly hard hit. In addition to the effects of the slow-down in the world economy, the increased export volumes from countries in Eastern Europe and the Commonwealth of Independent States

have exacerbated the oversupply in base metals. The volume of these shipments has increased the inventories of such metals as aluminium and nickel to record levels in the industrialized countries, with consequent downward pressure on prices.

6. On the other hand, there have been reasonably high levels of activity in the mineral industry in Canada, the United States of America and the larger mineral-producing countries of Latin America, although inflation and international debt problems continue to affect the expansion of mineral-resource development activities in Latin America. For the first time in many years, a major new world-class mine development has been inaugurated in Chile, with the start-up of the Escondida copper mine. In the Asia and Pacific region, the outlook of the mineral industry has improved, with increasing levels of activity in Australia and mineral development activities in a diverse range of countries or areas, such as Papua New Guinea, New Caledonia and Mongolia.

7. Moreover, in a number of developing countries, the consumption of metals and minerals has been increasing significantly. The newly industrialized countries of South-East Asia have attained considerable growth rates and have become substantial consumers of metals. China has been a substantial importer of aluminium, copper (concentrated and refined) and zinc during the past decade. In South America, Brazil, Chile and Peru have increased their metal consumption. 2/

8. Nevertheless, barring any major unforeseen developments, prices of virtually all metals and minerals are expected to fall substantially in the early 1990s as a consequence of the slow-down in the rate of growth of most industrialized countries and the coming on stream of a number of new large-scale projects. Moreover, the share of the developing countries in export receipts from major metals has been declining significantly and is expected to continue to do so. The decline in the metal-prices index in the early part of the 1990s will largely be the result of expected softening in the price of nickel, copper, lead, zinc and tin.

II. WAYS AND MEANS TO FACILITATE THE FLOWS OF FINANCIAL RESOURCES

9. An increasing number of developing countries have begun major restructuring programmes in the mineral sector and related areas in an effort to attract and facilitate the flow of private foreign capital. In varying degrees, mining legislation is in the process of being revised, the process of obtaining permits is being streamlined and tax structures and profit repatriation terms are being made more favourable. Efforts have also been made to undertake or upgrade geological surveys and to make the existing geological data more accessible. New funding mechanisms and in some cases the renewed application of already existing strategies are being introduced and are being structured to encourage major long-term investment.

10. The aim of this section of the report is to introduce and reinforce various ways and means of facilitating the flow of financial resources to the mineral sectors of developing countries. The emphasis is on methods of

attracting private foreign investment rather than aid sponsored by Governments or intergovernmental organizations. A greater influx of foreign private investment will enhance technology transfer and may lead to increases in bilateral aid. Because of the changing environmental legislation and government practices in many countries, particularly in parts of North America, many mining companies feel compelled to look for exploration and mining opportunities in other countries, where a shorter lead-time to actual mine start-up is anticipated.

A. Conditions of geology and mineral exploration

11. In making exploration investment decisions, different companies use a variety of decision-making criteria, which are not limited to geology but include political, marketing, regulatory, fiscal, monetary, environmental, administrative, operational and profit criteria. Therefore, in order to enhance the flow of private investment for mineral exploration in developing countries a multitude of issues must be addressed.

12. According to the results of a global survey published by the Economic and Social Commission for Asia and the Pacific (ESCAP), 3/ in which information from 39 exploration/mining companies headquartered in Africa, Asia, Australia, North America and Western Europe was gathered, the following geological criteria were listed as being important to very important in considering exploration investment: general mineral abundance, geological potential for target minerals, availability of geoscientific information and ability to apply geological assessment techniques. The survey suggested the following practical approaches to facilitating ready access to geological data in order to encourage and assist exploration programmes.

1. Geology

13. It was suggested that public access to existing geological data be increased by:

(a) Collecting existing data in one central location, under one agency. This might involve setting up a geological survey or department of mines in certain countries;

(b) Cataloguing data to current industry standards;

(c) Having reports and records available in common languages, including English. Existing reports/records were often only available in the language of the recipient country and/or language of the donor country (if prepared under a bilateral or multilateral aid agency);

(d) Allowing open access to geological information currently or formerly held by State monopolies;

(e) Making the database user-friendly.

14. Government-sponsored geological programmes, it was suggested, should be focused in such a way as to maximize results per dollar expended and improve geological information. This could be achieved by:

(a) Concentrating on airborne geophysics programmes and air-photo coverage;

(b) Updating existing surveys and focusing on good target areas using modern exploration techniques and deposit models, that is, disseminated deposits amenable to heap leach and solvent extraction.

15. In order to better assist external teams, it was suggested that geological and communication skills of resident geological survey teams be upgraded by:

(a) Having them continue to work closely with geological survey teams from other countries;

(b) Encouraging technology exchange programmes and industry/government exchange programmes;

(c) Having various geological survey teams host regional conferences.

16. It was suggested that, in countries with good geological potential, a local State geological body should be developed, if none existed.

2. Mineral exploration

17. In terms of encouraging foreign financial flows for mineral exploration, political, regulatory, investment, fiscal, environmental and monetary issues had emerged as key issues in the survey and concern had also been expressed over the bidding process for concessions in certain countries. Developing countries therefore needed to consider:

(a) Developing and maintaining clearly defined mineral development and fiscal policies with respect to exploration and development, clarifying positions on foreign ownership content, mandatory majority participation by Government and/or nationals, environment-related obligations, management control, tax structures, import/export policies, foreign-exchange regulations and repatriation of profits;

(b) Developing a clearly defined mining code;

(c) Ensuring consistency between fiscal or tax laws and mining laws. In some countries, for instance, although mining laws had been reformed and covered such areas as depreciation and depletion, such changes were not yet recognized by the fiscal or tax authorities, causing difficulties for foreign companies operating in those countries;

(d) Streamlining the process for obtaining the necessary exploration permits and guaranteeing ensuing right to mine;

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(e) Developing specific guidelines to regulate the bidding for and subsequent award of concessions in accordance with international standards of ethics and protocol. Rigorous confidentiality agreements should be in place, as well as a streamlined process to ensure legal title and security of tenure (see discussion in sect. II B below).

B. Conditions of mineral rights

18. Two key components stand out with respect to mineral rights:

(a) Mining legislation: this must be clear and concise and spell out the basic legal framework within which exploration and mining can take place. Stability of exploration and mining terms is crucial;

(b) Title and security of tenure: companies active in mining and exploration must be ensured of legal title and security of tenure to mining concessions/properties. This requires good local mineral-resource lawyers, an established mineral-titles system, the support of an organized government infrastructure and a minimum of discretionary practices.

C. Development of country image for mineral-resource development

19. Few industries have more reason to be concerned about country risk than mining. Mining investments by definition are capital-intensive, long-term, immobile exposures to variable tax, regulatory and business operating conditions. The capital invested in developing a mine may exceed US$ 100 million, in some cases more than US$ 500 million. Few projects in the manufacturing and service sectors involve equivalent capitalization. Mining has longer time horizons than other industries, since the time required from the beginning of construction until payback is often five years or more. This does not include the possible three to five or more years of exploration, drilling and assaying prior to commissioning a full feasibility study. Moreover, mining companies do not invest merely to achieve payback but also to realize a return on investment through profitable operations over the life of a mine. Unlike industrial concerns in other sectors, mines cannot relocate if conditions in a country deteriorate. Mines are held captive by the location of the resource and are subject to the prevailing conditions in the country of operation.

20. Mining sensitivity to country risk derives from the experience of the past 30 years. Most negative experiences with country risk have occurred in developing countries, as a result of expropriation, blockage to financial transfers or interruption of operations by war or insurrection. Expropriation with inadequate compensation ranks high in industry consciousness of past adverse treatment. Between 1960 and 1976 a significant number of mines were expropriated around the world.

21. Many of those expropriated mines are now being privatized, as Governments in Latin America, Africa and Eastern Europe implement a new policy of competing for foreign mining companies to develop their mineral resources and to own and

operate their mines. This new openness of many countries to foreign investment in mining presents great opportunities but also significant risk. Developing countries will therefore have to determine the best methods to mitigate the following perceived country risks: expropriation, restrictions on capital repatriation and dividend remittances, interruptions from war or insurrection, taxation changes, regulatory changes, corruption, social violence, inadequate local management and prevalence of infectious diseases. Paragraphs 22 to 28 below list a number of strategies available for mitigating the impact or reducing the probability of various country-risk factors and thereby enhancing country image.

Political risk insurance

22. In many cases, political risk insurance is available from a number of institutions to cover high-profile risks such as expropriation, blockage of the transfer of funds and war and insurrection. Primary sources are the Multilateral Investment Guarantee Agency (MIGA) and national agency insurers such as Export Development Corporation (EDC) of Canada and the United States Overseas Private Investment Corporation (OPIC). However, the amount of insurance available to any one project from these agencies may be limited and able to cover only a portion of a mine's capital exposure. For very high-risk countries insurance may not be available at all. Should this type of insurance not be available for specific country projects, further avenues should be explored.

Reducing the risk of blockage to financial transfers

23. World Bank involvement in project financing, particularly participation by the International Finance Corporation (IFC) in syndicated loans for a mining investment, may help to reduce the risk of blockage to financial transfers.

Bilateral investment protection treaties

24. A bilateral investment protection treaty may be negotiable or may already exist between the investing company's home country and the host country of the investment. Canada has signed such treaties with Argentina, Uruguay, the former Czechoslovakia, Hungary, Poland and the former Soviet Union, and is negotiating a treaty with the Russian Federation. Under a treaty, adverse treatment of an investment may trigger country-to-country discussions and the company may have recourse to binding international arbitration. Investment protection treaties do not diminish the potential impact on a mine of specified country-risk factors but they do help reduce the probability of occurrence. To the extent that a host country values its relationship with the investment company's home country, the host country can be expected to think twice before taking actions in contravention of the treaty.

Mine development agreements

25. A mine development agreement contracted between the investing company and the host country Government is intended to help reduce exposure to risk factors. A number of provisions are common in such contracts: the rate of taxation for the project may be guaranteed for a specified period; the free repatriation of capital and remittance of interest and dividends may be

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guaranteed, principally by provision for an offshore account for hard-currency transactions; the freedom of the mine to market its products globally may be guaranteed; and various operational conditions of the mine may be specified.

Equity participation by host Government

26. Equity participation in a mine by the host country Government or host country companies may in certain cases be useful in providing some security against adverse treatment by Government. The argument is that a Government will be less inclined to depress the profitability of a mine if doing so will adversely affect its own financial interest or that of nationals who have invested in the mine. An opposite argument, of course, can be made. Government equity participation provides a window to mine financing, which may assist the Government in devising strategies to extract more revenue. Obviously mining companies will be unhappy if equity participation by Governments leads to managerial interference by Governments. The advisability of equity participation by a host country Government or company in a mining project depends ultimately on country-specific conditions. In other words, one cannot generalize about this being a good idea.

Additional profits tax

27. An additional profits tax (APT) may in some cases be helpful in assuring taxation stability over time. If a project becomes highly profitable, APT automatically adjusts the Government's share upwards, thereby reducing pressure on a Government to extract greater revenue through tax increases or partial expropriation. Investing companies are understandably unenthusiastic about APT, but most are ultimately willing to live with it provided it is not unreasonably onerous. It should be noted that APT may encourage counter-productive management, as companies are likely to operate in ways which will minimize the likelihood of APT being triggered.

Other

28. In soliciting foreign investment, developing countries will need to meet with key foreign government, industry and financing institutions to communicate recent reforms of and changes to mining, investment and fiscal regimes. The following programmes should be considered:

(a) Country-specific information packages and presentations should be developed, covering geological information, mining laws and regulations, current operations, potential prospects, privatization opportunities, physical infrastructure, financial and economic data and country policies;

(b) Key political figures with relevant expertise should be part of a government negotiating team, similar to industry-analyst seminars now conducted by various mining houses in the developed countries;

(c) Integrated information centres, "one-stop shops", should be set up to provide interested companies with detailed geological, mining, tax, economic and financial data;

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(d) Country delegations should consider sponsoring and/or attending special seminars aimed at informing possible foreign investors of emerging opportunities. A number of countries have held such seminars in recent times, either on their own or in cooperation with bilateral and multilateral institutions.

D. Equity funding

29. Developing country companies are able to source equity funding from direct private placements, joint venturing and listings of stock on exchanges and subsequent equity offerings. Most projects require a minimum level of equity in order to qualify for debt financing.

Developing country exchanges

30. Sri Lanka, India, Thailand, Malaysia, Singapore, Brazil, the Philippines, the Republic of Korea, Indonesia, Mexico, Turkey, Ghana and China, among other developing countries, have stock exchanges. Generally there is an ownership restriction on the amount of stock which can be held by foreigners.

31. Fundamental to the volume of trading in a stock and hence to its value is the secondary market coverage. Unless a stock is well supported by a good international underwriting firm and its analysts, full value will be difficult to realize and access to private institutional investors limited. As a means of encouraging wider distribution of mineral-resource stock, companies in developing countries might consider the following strategies:

(a) Inter-listing on a major resource board such as the Vancouver Stock Exchange. This would provide immediate access to an effective international trading and settlement capability through which North American and European investors could participate; it would give extensive international exposure, enhance a company's profile internationally and extend the trading hours for these issues. Obviously certain criteria would need to be discussed in order to ensure the successful placing of inter-listed issues;

(b) In conjunction with a global brokerage firm, consideration should be given to developing an equity derivative product around emerging mineral growth stocks.

E. Project finance sources

32. Companies are having to look at a variety of innovative means to finance projects in developing countries. Conventional debt finance through schedule A banks is not always available, due to political country-risk factors and the reserve requirements placed on companies by their own government agencies. Therefore, multilateral lending institutions have been actively involved in structuring and placing loans for certain projects and for providing the necessary guarantees. In addition, there are some interesting forms of project finance emerging, based on the careful structuring and packaging of lending in order to minimize risk. In addition to political risk factors, environmental liability risk is emerging as a key concern to lending institutions.

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33. Apart from equity, possible forms of project finance include commodity loans, equipment leases, trade finance, long-term sales contracts and debt finance backed by commodity and currency hedging and option programmes. Niche lenders are likely sources of funding, as well as the major metal-trading houses which require long-term sources of feed for smelters. In order to facilitate the flow of project finance to the developing countries the following might be considered:

(a) Commodity loans: in certain countries, approvals for commodity loans and the required risk management programmes are difficult to achieve. Increasingly, commodity lending and risk management programmes are becoming part of project finance structures;

(b) Equipment loans: large manufacturers of heavy equipment are offering equipment leases as part of an overall finance package. Repatriation of funds and the ability to hold funds in offshore accounts is important in facilitating this form of finance;

(c) Long-term sales contracts: as a means of securing a source of feed for smelters, certain Japanese and other metal-trading companies are prepared to provide either equity or debt finance to projects in developing countries. The consortium led by a Japanese company in the Escondida Project in Chile is an example of such a form of finance. To facilitate this form of finance, Governments must be prepared to allow free export of concentrate to the investing company's facility offshore. Mandatory quotas to local smelters would make this type of facility less feasible;

(d) Guarantees: institutions offering project financing have to be comfortable with their guarantees. To facilitate this process, in addition to the normal charges over assets, completion guarantees, parent-company guarantees and so on, certain high-risk countries might consider designating a neutral zone over which a multilateral agency would have control. Title to commodities delivered to this area would then be out of the control of the country and pass to the funding institution.

F. Structure and implementation

34. To facilitate the flow of funds earmarked for the mineral-resource sector in developing countries, finance packages are being devised to minimize the exposure of any one company and lending source. Combinations can now include: equity from more than one source, including the IFC; debt by way of equipment lease, commodity funding; and combined debt/equity packages through long-term sales contracts, whereby funds to the project are secured against long-term flow of product. This type of funding is typically provided by the Japanese trading houses which represent smelters or by other major trading groups representing smelters/refiners or end-users. Actual proportions of debt and equity are balanced against projected cash flows and project owners' contribution and perceived creditworthiness. Risk management programmes to minimize fluctuation in metal prices, currency and interest rate exposure are commonplace and are designed to meet specific project cash flow criteria, as are specific completion test guarantees and insurance requirements. Draw-down of funding is scheduled against specific project time-line criteria.

G. Identification, minimization and assignment of risk

35. Experienced international mining firms and lending institutions apply rigorous programmes for identifying, assessing and minimizing risk. Risk may be placed in three broad categories: technical, commercial and financial, and political. Paragraphs 36 to 40 below define the risk area, highlight the principal sources of risk and indicate the appropriate risk management techniques which could apply.

1. Technical risk

36. Technical risk can be managed by setting up and following specified project evaluation procedures, adhering to best-practice technical standards throughout and performing rigorous testing and analysis through the feasibility study process. This can be achieved by sharing expertise through joint venturing with competent exploration and mining companies; establishing training programmes locally and abroad; hiring top consulting firms experienced in mineral exploration and development; and exchanging information through technical conferences and associations. Key risk areas include:

(a) Reserve estimation;

(b) Site evaluation/geotechnical studies;

(c) Mine design and planning;

(d) Ore treatment and recovery (metallurgy);

(e) Location and services;

(f) Environmental concerns and permitting;

(g) Availability of labour and services (management and general);

(h) Legal environment, including land title, tenure, ownership, joint venture or other agreements;

(i) Calculations of costs, including capital, operating and infrastructure;

(j) Overall project economics, including sensitivity studies;

(k) Permitting process;

(l) Marketing.

37. Lending institutions protect project lending risk in this area by structuring agreements so that certain completion test requirements are met. With respect to environmental risk, this area has become increasingly important to developing countries, banks and other lending groups and mining companies. Approximately one year ago, an international industry group was set up by about 20 of the key international mining firms to address the issue. Membership

includes key Canadian, Australian, Mexican, Chilean and European firms, such as INCO, ASARCO, Noranda, Cominco, BHP, RTZ and Placer Dome. The group, the International Council of Metals and the Environment (ICME), is headquartered in Ottawa and met recently in London to further develop its agenda and scope of operations. The group sees itself as a resource base for government and multilateral institutions on issues related to developing and coordinating world wide environmental standards for the mineral-resource industry.

38. On the subject of the legal environment, efforts are now under way in many developing countries to revise mining legislation and streamline the permitting process. This effort is being recognized by the international mining community and supported through an increased investment response, most noticeably in Chile and Mexico. It is strongly recommended that this process continue as a major incentive towards investment.

2. Commercial and financial risk

39. Risk management techniques are available for many of the components of commercial risk. However, modifications to enhance coverage could be achieved and are addressed below. Key commercial risks include:

(a) Excess volatility in metal prices, interest rates, foreign exchange rates and equity markets;

(b) Non-performance on sales and marketing contracts due to technical or other reasons;

(c) Business-related causes of non-payment, such as insolvency, default, repudiation of goods by buyer and contract termination;

(d) Prompt and efficient transfer of funds;

(e) Inability to secure financing.

Commodity, interest rate and foreign exchange volatility

40. Hedging, option and derivative products exist in the international financial markets to limit exposure to market price movements and are generally required as a provision to debt financing to ensure that coverage ratios are met. Financial lending institutions prefer access to the metal and/or currency offshore in order to feel comfortable structuring such an instrument. Access can come in the form of guarantees by liquid offshore company affiliates or the maintenance of direct accounts offshore. Inter-agency guarantees can also be helpful.

Non-performance on sales and marketing contracts

41. Longer-term contractual sales and marketing arrangements are generally preferred to facilitate new project financing. Non-performance, whether deliberate or categorized as force majeure under standard marketing contracts, does occur. Producers can limit risk by having contracts with more than one buyer or by stipulating that material may be shipped to alternate works/buyers

as a result of force majeure provisions. Some refining companies have operations in a number of countries, and producers often specify that material can be shipped to various locations in the event of problems, which facilitates and expedites payment.

Business-related causes of non-payment

42. Insurance is available for foreign investors through national agency insurers to cover various non-payment exposures. However, certain developing countries are considered by these insurers to be off cover either permanently or from time to time. Consideration needs to be given to developing an insurance network to cover certain of these risks for countries where mineral-resource development is a high priority.

Transfer of funds

43. In certain cases, either the financial system in a developing country is not sufficiently developed to expedite funds or funds are deliberately held up due to documentation irregularities. This results in negative investment responses by outside companies and lenders. While national agency insurers can and do cover certain exposures as indicated above, programmes are now being introduced in Canada to train staff in export expediting. It is recommended that similar training programmes be set up for key country staff to assist in the development of best practices for bank authorization procedures, documentation, international letter of credit procedures etc. Introduction of international bank clearing mechanisms might also be useful.

3. Political risk

44. Political risk is a critical consideration of many investors and lending institutions and covers such non-commercial areas as difficulty in repatriation of funds due to currency and foreign-exchange policy changes, war, revolution or insurrection; expropriation; tax and regulatory changes; corruption; and social violence. Specific ways and means to address these issues have been covered in paragraphs 22-28 above. Lending by international banks will generally be withheld if adequate coverage cannot be obtained from MIGA, bilateral or private agency insurers.

H. Sources of finance

45. There are a number of multilateral, bilateral and private programmes currently in place to assist developing nations in the financing of their mineral-resources development. These include the multilateral development banks, also known as international financial institutions; the United Nations Development Programme (UNDP) and its affiliates; the Arab development funds and investment banks; the Commonwealth secretariat; the European Community (EC); and direct bilateral aid programmes. Non-governmental organizations and corporations are also direct sources of finance.

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Multilateral development banks

46. There are six established multilateral development banks: the World Bank, the Inter-American Development Bank, the Asian Development Bank, the Caribbean Development Bank, the African Development Bank (AfDB) and the European Bank for Reconstruction and Development.

Other multilateral financing sources

47. In addition to the six established multilateral banks which provide funding and technical assistance to the mineral sector, there are two major development groups which make contributions, including grant financing: the United Nations system (UNDP, the United Nations Revolving Fund for Natural Resources Exploration (UNRFNRE) etc.) and Arab development funds and investment banks.

Other significant organizations

48. In addition to the large multilateral financial institutions, other large organizations form part of the economic development network. Through a variety of programmes and organizations, they actively provide support for the development of the mineral sector. The Commonwealth secretariat and the European Community form part of this group.

Corporate investment

49. Though not classified as aid, major funding and development expertise comes from international mining sector companies and affiliates. This source of funding and expertise will continue to expand as the investment climate in developing countries is enhanced by changes of political structure, major revisions to mining laws and improved access to geological and exploration data. Small, intermediate and large international mining and processing firms are actively involved world wide in the development of the mineral sector. They are joined by technical service firms, parts and equipment suppliers, trading companies and financial institutions in the development of exploration properties to full-fledged mining and processing operations.

III. EXISTING PROGRAMMES TO SUPPORT THE EFFORTS OF DEVELOPING COUNTRIES IN SECURING INVESTMENTS REQUIRED FOR DEVELOPMENT OF MINERAL RESOURCES

50. As discussed in paragraphs 45-49 above, financial aid and technical assistance programmes are currently available through the large multilateral development banks, the United Nations agencies and regional institutions, bilateral government programmes, non-governmental organizations and country associations. Mineral-resource financing through corporate investment by private and publicly held companies will again become an important factor as developing countries reorient their focus to market-based economies.

51. An overview of the major government-related organizations offering financial and technical assistance aid to developing countries was presented in the preceding section. The present section outlines, in anecdotal style,

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practical applications of the various programmes offered by these institutions to support the efforts of developing countries in securing the investments (financial and non-financial) required for the development of their mineral-resources. The programmes are presented according to function in an effort to show the depth and breadth of the programmes.

A. Information services

52. In recent years, a growing number of Governments in Africa, Asia and Latin America have begun reopening their doors to foreign investors. In order to attract foreign investment, major changes to mining codes and tax regimes were required, as well as access to detailed reviews of mineral-resources and other geological data. In order to accomplish this a widespread information services network was also necessary. A number of services have been set up to provide these countries with the necessary support.

Foreign Investment Advisory Service

53. MIGA, jointly with IFC, operates the Foreign Investment Advisory Service (FIAS), which advises Governments on the laws, policies, regulations and procedures necessary to create an adequate investment climate to increase inflows of foreign direct investment. As part of this programme, MIGA also sponsors investment promotion conferences.

United Nations system

54. The United Nations system has been involved in providing information support services to developing country mineral-resource sectors. It also advises Governments on the laws, policies, regulations etc., necessary to create a favourable investment climate for the mineral-resource sector. For example, the Department of Economic and Social Development (incorporating the former Department of Technical Cooperation for Development), in collaboration with the Philippine Department of the Environment and Natural Resources, recently prepared a 200-page prospectus which included information on the country's geology and mineralization, mines, mining law, regulations, policies governing mineral exploration and production. A similar document, entitled "Tanzania - opportunities for mineral-resource development", was prepared for the Government of the United Republic of Tanzania in 1991. In addition, as a follow-up to the Philippines prospectus, three information seminars were scheduled in February and March of 1992 to cover topics ranging from geology and current mining activities to the legal framework within which mineral exploration is conducted. 4/

55. The Department of Economic and Social Development has also been very involved in the drafting of new mining codes aimed at attracting foreign investment. Programmes have recently been undertaken in several West African countries, with emphasis on the least developed and land-locked countries of the region, where new mining codes are being drafted aimed at attracting small to medium investments and to promote artisanal mining, and in Ethiopia, where a recent new mining legislation study was undertaken.

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56. In Malaysia, after a three-year study by the Primary Industry Ministry, with assistance from UNDP, a new mineral development policy has been formulated, with Government approval still pending. Under the new policy, miners will be assured of security of tenure, enjoy lower royalty payments and be entitled to improved tax incentives. Foreign mining investors will be allowed to raise their ownership in Malaysian ventures from the current 30 per cent to 100 per cent. The policy also proposes income tax allowances on exploration expenditure and the abolition or reduction of import duties on mining equipment. Similar new mining codes have been adopted in Mexico and Peru.

Trade Development Programme - United States of America

57. The United States State Department, through its Trade Development Programme, is also actively involved in promoting foreign investment in developing countries. It recently completed publication of a joint United States Geological Survey and Servicio Geológico de Bolivia open-file report (91.0286), entitled "Mineral deposits and occurrences of the Bolivian altiplano and Cordillera Occidental, a database of all mineral occurrences in the provinces of La Paz, Oruro and Potosí".

B. Mineral exploration and development programmes

58. It is evident that developing nations are moving towards the encouragement of foreign investments as a means of developing their mineral sectors. Many of the programmes discussed focus on the identification of possible investment opportunities and the subsequent work undertaken to further enhance the resource. These mineral exploration and development programmes are currently being funded through a variety of multilateral and bilateral programmes, as well as directly by international mining groups. A cross-section of programmes is highlighted in paragraphs 59-80 below.

Multilateral programmes

59. The United Nations system has been providing assistance in mineral-resource development programmes in the developing countries of Africa; Latin America and the Caribbean; and Asia and the Pacific. The programmes are being executed, mainly with UNDP funding, by the Department of Economic and Social Development, the regional commissions, the specialized agencies and to a lesser extent UNRFNRE. A few illustrative examples of such activities are described below in paragraphs 60-67.

60. In Latin America, Department of Economic and Social Development programmes have been well utilized, with projects in a growing number of countries, including Guatemala, Honduras, Bolivia and Ecuador. The projects have ranged from conducting assessments of mineral-resources to detailed sampling programmes and further delineation of reserves.

61. The situation in Ecuador is worth noting. In August 1991, Armenonie del Ecuador SA, an Ecuadorean registered mining company with foreign capital, together with a Canadian company and a Japanese company (Armeno Resources Inc. and Nissho Iwai Corp., 50 per cent each) began a joint venture to bring the San

Bartolomé polymetallic mine into production. This is the first underground mining operation in the country in the last 15 years and the first UNRFNRE project in the world from its preliminary exploration programme that has become a productive mine.

62. Since August 1987, UNDP and the Department of Economic and Social Development have provided considerable assistance to Bolivia. A tremendous amount of field-work has been carried out by consultants, the United Nations and Geobol geologists on prospective investment opportunities. The programme has included an assessment of non-metallic resources in Bolivia, an assessment of the alluvial gold potential in Bolivia, detailed sampling of the oxidized zone on Cerro Rico de Potosí and studies on porphyry systems and disseminated gold in sedimentary rocks. Under the assistance programmes, a drilling programme was started in 1991 on the auriferous moraines near Lake Suches (230 km north-west of La Paz).

63. The Department of Economic and Social Development is carrying out assistance programmes in Africa and the Far East. In Sri Lanka, UNRFNRE has offered funding to the Government of Sri Lanka for prospecting for such heavy minerals as ilmenite, rutile, monazite and zircon. The exploration programme will cover the south-western coastal areas in Beruwala and Devinuwara.

64. In Africa, the Department of Economic and Social Development recently financed resource definition work to determine the size of reserves and the characteristics of graphite at the Ancuabe deposit in the northern part of Mozambique - one of several deposits identified as a result of the Hunting aerial survey.

65. In Gabon, favourable results have been obtained by a survey, done in collaboration with the Department of Economic and Social Development, of the potential of the Kolissen gold area about 50 km east of Lamberéné and of the Ndjolé alluvial gold district. The survey has also revealed anomalous gold and base metal values around Nkan, some 50 km north of Ndjolé and 150 km east of Libreville.

66. The United Republic of Tanzania, a country with a rich and diversified mineral potential, is actively cooperating with the United Nations to promote mineral investment. In addition, detailed exploration work is being carried out with United Nations assistance.

67. In Mali, the Syama deposit in the southern Bogoé region was discovered during a gold prospecting project financed by UNDP. In Chad, a mineral inventory and cartography on a semi-detailed scale are under way with the help of UNDP.

Other multilateral programmes

68. In Ethiopia, the Government received assistance from the African Development Fund to carry out further exploration work which could guarantee the expansion of the Lega Dembi mine. The African Development Bank is also involved in funding the final feasibility study for the Matongo igneous phosphate project in Burundi. In Burundi, the European Development Fund is involved in providing funds for a portion of the second phase of the core

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drilling programme of the Masaka gold deposit located in the north-east of the country. In Uganda, the International Development Agency has extended credit to the Government of Uganda to conduct a feasibility study on tin and wolfram in order to guide investments in these minerals.

Bilateral aid programmes

69. In addition to funding multilateral programmes, many developed countries carry out direct aid programmes with developing country Governments. These programmes, depending on what is required, may be channelled directly through the central Government agency, or through various separate agencies, such as technical and economic agencies or export development agencies. Bilateral programmes may take any of the several forms outlined in paragraphs 70-73 below.

70. Project aid assistance may be focused on specific projects involving engineering services, technical assistance and training and equipment supply for the construction of an integral capital facility. Project equipment and services are largely provided by donor country firms, which are chosen through a competitive process.

71. Programme aid and lines of credit assistance can be less focused, covering programme aid and lines of credit. Programme aid provides the Government of a recipient country with commodities which support a number of projects of a developmental nature. A general line of credit enables recipient countries to purchase equipment and services from donor country suppliers. Financial institutions of selected developing countries may also be recipients of loans for on-lending to development finance companies. These funds are passed on to private sector borrowers, usually for medium-scale investment projects, on commercial terms.

72. Sector-specific programmes provide equipment and services in areas of donor country expertise for the development of a specific sector identified by the recipient country as a priority.

73. In support of the programmes outlined above, donor countries also finance feasibility studies and detailed engineering and design work for projects of high developmental value. Paragraphs 74-80 below contain examples of bilateral programmes under way, which are included to illustrate the range of assistance available.

74. Canada tends to channel its bilateral aid through the Canadian International Development Agency (CIDA). It sponsors direct project aid programmes and through its Industrial Cooperation Programme will consider funding specific technical and feasibility study programmes. CIDA recently provided funding for the completion of a feasibility study for a potential gold mine in Costa Rica.

75. France is actively involved in exploration activities through its government arm, the Bureau de Recherches Geologiques et Minières (BRGM). In many instances, BRGM acts in a manner similar to a private foreign investor, providing funding and expertise in exchange for an equity position in a project. On other occasions it acts in a bilateral aid capacity. BRGM is

active in Africa and increasingly so in Latin America. Recent activities include a geological survey for gold in the Busia subdistrict of Uganda, the results of which have been submitted to the Government. The survey discovered new gold deposits at Bukade and confirmed other deposits at Osofiri, Makera, and Kitojja Budde. In addition, BRGM recently evaluated a rutile deposit in the Akonolinga area of Cameroon. The evaluation was done as a joint venture between the Government of Cameroon and BRGM. A geological survey has also recently been concluded in Haiti.

76. Germany has been actively involved in providing funding for bilateral technical assistance programmes for the mineral sector. It has recently funded mineral survey and exploration programmes. For example, it was involved in a joint German-Tanzanian gold exploration programme over the Siga and Mbale Hills and in a gold exploration project in the north-west of Burundi. The aid project is being undertaken by Bundesanstalt für Geowissenschaften und Rohstoffe, the German Federal Geoscience Institute.

77. Japan has a number of funding agencies directly involved in bilateral programmes including the Japanese International Development Agency (JIDA), the Overseas Economic Cooperation Fund (OECF), the Japanese International Cooperation Agency (JICA) and the Metal Mining Agency of Japan (MMAJ). MMAJ is extremely active in providing technical assistance in developing countries. It also gathers data on mineral resources for mining investment projects and studies. For example, in 1990 the Governments of Fiji and Japan entered into a three-year programme of mineral exploration activity covering Viti Levu Island in Fiji. The gold-oriented project was fully funded by the Government of Japan via its agent MMAJ. In the first year of the programme, regional mapping and sampling were conducted to identify areas with mineralization potential for further detailed studies. During 1991, detailed mapping and soil geochemical sampling was conducted over most of the Island. The work culminated in the drilling of two diamond drill holes, total depth 602 m. 5/

78. According to recent reports, MMAJ will soon start a three-year exploration study with its counterpart in the Government of Mongolia. Work will be focused on a polymetallic vein deposit in north-east Mongolia, near the Chinese-Russian border. In Pakistan, the Geological Survey of Pakistan (GSP) has established a modern, well-equipped geoscience laboratory in Islamabad under technical assistance from the Government of Japan through JICA, which provided a grant of ¥1,433 million. 6/ The Geological Survey of Japan supervised the installation of the equipment and is training GSP staff. A similar laboratory has also been established in Panama. Japan has also been involved in geological mapping programmes in the Dominican Republic through JICA and in Honduras through JIDA. Through OECF, it has offered assistance to Sri Lanka to import quarrying, earth-moving, excavating and other mining equipment.

79. Sweden: it has been involved in a number of countries on a bilateral and multilateral basis through the Swedish Commission for Technical and Economic Cooperation (BITS), the Swedish Agency for Research Cooperation with Developing Countries (SAREC) and the Swedish Geological Survey (SGAB). SGAB is currently considering funding the development of a mines department in Nicaragua, since no such body currently exists. Sweden has also been involved in geological mapping programmes through BITS.

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80. In the United States of America the United States Geological Survey (USGS) has recently been involved in producing and updating geological and mineral-resource maps. In addition, USGS has been involved in providing and funding a research facility. The United States also provides a full range of export and related financing services through the Overseas Private Investment Agency (OPIC).

C. Project and general finance programmes

81. Project and general finance programmes for the development and expansion of mining projects in developing countries are offered by the large multilateral banks (IFC/World Bank being the most prominent); the Commonwealth Development Corporation (CDC); country-specific institutions such as OPIC in the United States, the German Finance Company for Investment in Developing Countries (DEG) and the Fukuda Fund, set up by the Government of Japan to invest in Association of South-East Asian Nations (ASEAN) countries; and small regional institutions with funds provided through multilateral and bilateral programmes. Where private investment is involved, it is important to secure export risk management and financing services, including commercial and non-commercial risk insurance. Commercial and non-commercial risk insurance is available from national agency insurers and from private insurance agencies. Export financing, including credits to foreign customers, purchase of customer promissory notes, arrangement of credit lines for developing country buyers and direct loans, can be made available through the national agency insurers. A comprehensive package of non-commercial risk insurance is offered through MIGA. Examples of recent financing are contained in paragraphs 82-88 below.

82. Namibia: the Geneva-based Société Internationalé Financière pour les Investissements et le Développement en Afrique (SIFIDA) has approved a US$ 1.1 million loan facility for the development of lead-zinc and associated operations run by South Africa's AFMIN holdings in central Namibia. The loan is the first SIFIDA commitment to Namibia and will be used for a US$ 1.5 million expansion and diversification programme at the mining operation of an AFMIN subsidiary, near Swakopmund. 7/

83. Ghana: a US$ 140 million syndicated loan, led by IFC which is providing US$ 40 million of the total, will help finance the expansion programme of the Ashanti gold mine. The expansion includes the construction of a new sulphide ore treatment plant, which will use a new bio-oxidation treatment process. The loan, which is one of the largest made by IFC in Africa, has been syndicated with a group of nine international banks. 8/

84. Sierra Leone: IFC has signed an agreement to provide a US$ 15 million loan to Sierra Rutile Ltd., marking the resumption of international lending for projects in Sierra Leone. Sierra Rutile is rehabilitating its plant and infrastructure and developing new deposits for a total estimated cost of US$ 48 million. Funds will be provided by OPIC, CDC, and DEG. 9/

85. Tunisia: IFC recently announced that it will help finance the development of the Bougrine lead-zinc mine in Tunisia. IFC will provide financing in the form of a US$ 14 million loan and an equity investment of US$ 2.1 million. Deutsche Investitions und Entwicklungsgesellschaft of Germany will provide a

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loan of US$ 11.3 million. Total project capital cost is estimated at US$ 50 million. 10/

86. Mauritania: a feasibility study was completed in May 1990 for the development of higher grade iron ore deposits at M'Houdat, about 60 km north-east of Zouérate. Under an agreement ratified in April 1991, the Société Nationale Industriale et Minière, is to receive US$ 60 million from the African Development Bank, plus a loan of 60 million European currency units (ECUs) from the European Investment Bank and FF 300 million from Caisse Centrale Pour Coopération Economique. 11/

87. Peru: by the end of 1991, a US$ 20 million emergency credit line, approved by the Andean Finance Corporation, was channelled to the mining sector through the private banking system. Peru is currently in the process of privatizing certain mining assets as a means of restructuring and modernizing its State-owned industry. 12/

88. Guinea: during 1991, the go-ahead was given for a two-year investment programme to modernize the alumina refinery at Friguia and to upgrade the rail link between Friguia and the port of Conakry. Assistance of US$ 19 million is to be provided by the European Investment Bank under the Fourth Lomé Convention. 13/

D. Technical assistance and training programmes

89. Technical assistance and training programmes are fundamental to the sustained development of a country's mineral resources. As discussed above, multilateral and bilateral programmes, as well as private programmes, all provide assistance in this area. Industry groups and associations also play an integral role and will be discussed in the following section. Examples of current programmes are contained in paragraphs 92 and 93 below.

90. UNDP, through the Department of Economic and Social Development and the regional commissions, is an active supporter of training programmes related to the development of the mineral sector. For example, a four-year project of US$ 2.6 million for training in specialized mineral exploration techniques has been approved for Ethiopia. In August 1991, UNDP granted aid of US$ 3.6 million to the Department of Mines in Chad for reinforcement of its technical capabilities. In Sri Lanka, assistance was sought by mine owners and traders for processing graphite, mica and silica. This was provided through the United Nations Industrial Development Organization (UNIDO).

91. RTZ, a major international mining house headquartered in London, has sponsored a technical management in mining training programme since 1982 in collaboration with the Government of Zimbabwe and London University. The Technical Management Training Trust is focused on providing technical management training to African nationals. The training, which takes place in Europe, lasts 20 months and culminates with work experience in various African mine settings. After nine years of operation, 43 Africans have participated in the programme, with the majority now holding senior positions in the region's mining sector. The programme, which was originally focused on Zimbabwe is to

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be expanded to include nearby countries. However, RTZ will no longer be sponsoring the programme.

E. Networking: industry groups and associations

92. To facilitate international and interdisciplinary cooperation, a number of industry groups and associations, specific to the mineral sector have been set up over the years. Many are sponsored through international bodies, such as the United Nations and the Commonwealth secretariat, while others have been organized within a specific sector of the industry and are funded by corporate contributions.

IV. TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES

A. Transfer of technology through foreign direct investment

93. Probably the most significant action taken by developing countries towards encouraging technology transfer has been that of encouraging and supporting foreign private investment in mining. While there are a number of multilateral and bilateral programmes available to facilitate the development of the mineral sector in developing countries and hence also facilitate technology transfer, the mechanisms, level of funding and guarantees are inadequate to support the massive restructuring and modernization required and the new mine potential in these countries. Lack of infrastructure and a skilled workforce are also problematic.

94. A more rapid flow of funding and expertise is required to expedite the transfer of technology to upgrade existing operations, develop new opportunities and in certain countries, such as the Lao People's Democratic Republic, to found a complete new industry. This is likely to come largely from the private sector. Recent changes in mining and tax regimes, active privatization programmes, and successful streamlining of Government processes have also sent a powerful message to companies actively searching world wide to replace and/or expand reserves. With an injection of capital will come access to additional expertise and increasing transfer of technology, both hard technology, such as mining and processing, and soft technology, such as marketing and hedging. However, the process is still in the initial stages and shareholders and financial institutions will require that their companies proceed with caution. This implies that companies will carefully weigh the risks prior to proceeding, particularly in countries perceived as more difficult or politically unstable and will look to such approaches as joint ventures and syndicated projects to minimize exposure. It is likely that this approach, combined with multilateral funding, will result in a more balanced globalization of the mineral sector than would direct takeover by multinational firms.

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1. Mining and recovery techniques

95. Technology transfer is taking place as a result of current direct foreign investment, informal and formal exchange of information through technical seminars and upgrading by State owned enterprises such as Codelco in Chile and Vale do Rio Doce in Brazil, as political will and funds are available. Two key examples, in the copper and gold industry sectors, are the emergence of gold heap leach technology and copper solvent extraction-electrowinning (SX-EW) technology. These two industry-changing techniques were developed by mining companies re-examining all possible ways to remain competitive in response to severe cost price pressures in the early 1980s. The result is that deposits previously considered uneconomic or unsuitable for conventional mining and milling techniques have become economic producers. In addition, low-grade oxide deposits are now major exploration targets, which has refocused exploration activity, particularly in developing countries, where there has been little exploration of this nature.

SX-EW

96. SX-EW is a proven method of extracting high-grade copper cathode from low-grade copper oxide ore. The process utilizes a combination of conventional heap leach technology, electrolysis and chemical reagents and bypasses the smelting process. As a result, SX-EW costs are typically below US$ 0.50/lb of copper produced, composed to conventional sulphide milling and flotation costs of between US$ 0.65 and US$ 1.00/lb. SX-EW produces a high-quality cathode product which can be shipped directly to end-users, rather than producing a concentrate which requires smelting and refining. The rapid progress in heap leaching, solvent extraction and electrowinning technology has changed the economies of certain copper resources not previously considered viable. According to a study by Commodities Research Unit Ltd., it is expected that well over 40 per cent of production from new capacity will come in the form of low-cost, electrowon copper. Mining companies are increasingly turning to developing countries for these low cost ore bodies in an effort to replace higher-cost reserves elsewhere. Deposits in Chile and Mexico are particularly amenable to this type of process.

Gold heap leach technology

97. Gold heap leach technology advanced rapidly in the 1980s, transforming low-grade oxide resources (predominantly in the United States) into low-cost mines. This technology is well known by major producers and will dominate development of large low-grade deposits world wide as companies look to replace reserves.

Smelter process technology

98. Another area of significant technological change has been in the smelter/refinery process area as companies have been pushed to improve recovery, reduce costs and meet increasingly stringent environmental emission guidelines. Major changes have taken place at a number of custom smelters. In addition, new custom smelters are required to meet anticipated demands and will probably be built by companies with vested interests in the end product. This

foreign investment by existing companies will bring with it state-of-the-art process technology.

99. Mining seminars as a forum for focusing on this changing technology in the copper industry are now commonplace. For example, the Copper 1991-Cobre 1991 seminar, held in Ottawa, was devoted to copper extraction technology. It was a follow-up to the successful Copper 87 Conference held in Chile, which focused on the changes that had taken place in the industry, including greater use of oxygen, growth of SX-EW production, plant modernization and expansion, improved sulphur capture and plant environment, development of improved control systems and increased recoveries. An excellent example of technology transfer discussed at the conference was the planned adoption of the Codelco smelting technique to modernize the Zambia Consolidated Copper Mines Nkana smelter in Zambia. It is planned to use Codelco pyrometallurgical techniques both for oxygen and fuel oil.

2. Finance and marketing

100. As global financial systems become less stable and perceived political risk factors remain high in many developing countries, financing and finance structures are becoming more complex and of necessity involve more participants. More sophisticated financial skills to incorporate risk management techniques are being developed within multinational mining firms, lending institutions, Governments and State-owned mineral-resource companies. Faced with a need to compete for a limited amount of funds, innovative arrangements are being structured. Developing country Governments are actively seeking extensive information on these new arrangements in order to deal successfully with multinational institutions, scheduled lenders and companies wishing to structure deals.

101. It is important to note that a number of financial institutions and companies are willing to train, internally, staff from government- and State-run companies, as the perceived risk of doing business is reduced by all players having a sound knowledge of fundamentals. This is particularly true on the marketing and hedging side of the business. This attitude has come a long way from that which prevailed in the late 1970s and early 1980s, when ignorance was valued as a means of extracting greater profit. Simply put, ignorance is now seen as too high a risk factor in structuring and maintaining solid financial structures.

3. Management

102. Management expertise is a valued commodity in a world which has changed significantly since the early 1980s, all the more so since the major restructuring of the global financial and social system in the mid-to-late 1980s. The skills needed now have moved from a specific set of functional skills to a wider range of technical, financial and leadership skills.

103. Major multinational as well as junior firms are recognizing the need both to train managers globally across a range of skills and to train local managers, in order to have operations that function appropriately in a highly

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cost-conscious, competitive environment. More effort is going into developing local management in addition to an international team of managers because companies realize that sustainable growth depends on a local infrastructure playing an important role in the internationalization of their operations.

104. This is a positive step for developing countries. These programmes are also being enhanced by the many technical exchange, university exchange and assistance programmes offered by multilateral, bilateral and non-governmental organizations. Management development should be enhanced by the introduction of privatization and joint ventures as expertise flows through the new partnerships.

B. Feasibility of establishing geological information systems in developing countries

105. Geoscience information is essential to Governments for the development of sound public policies on the management of mineral, energy and water resources; the management of risk due to natural hazards (earthquakes, floods, volcanic eruptions, etc.); and the protection of the environment and human health. Geoscience information is also required as an instrument of government policy. Among other things, the information is made available by Governments to specific audiences, such as the mineral exploration industry or particular government departments, in order to stimulate national development of natural resources, to reduce the risk due to natural hazards or to promote environmentally sound economic development. This information is of universal application because it forms an integral part of the information framework within which any Government must govern and any nation must function. National geological survey departments are the providers of this information.

106. Government policies can only be developed and implemented if geoscience information is easily available in a form suitable for the users of the information. Nations endowed with rich mineral resources and a government policy to develop these resources in an environmentally responsible manner, if they wish to attract direct foreign investment in the minerals sector, must develop modern geological information services. Without this capability, they will not be in a competitive position over the next decade, relative to other nations that offer information services based on geoscience information databases. As exploration activities in the private sector become dominantly computer-based it will be increasingly more difficult for exploration staff to work effectively with paper-based information.

1. Organizational context

107. A geoscience information project should be implemented in response to a clearly defined goal. This goal should also be within the mandate of the organization that will host the information system. The mandate of a geological survey is founded on government policy and ideally looks outward from the organization. Its purpose is to focus on objectives such as (1) improving the economic vitality of the country by attracting investment; and (2) providing information to ensure the orderly management of a particular economic activity in a sustainable manner. A fundamental feature of geoscience

information projects should be that they are not implemented for the good of the geological survey but rather to serve the clients who are the end-users of the information. The viability of an information project depends on the clarity with which its goals are set and how the requirements of the end-users are integrated into the project design.

108. The collection, management and distribution of geoscience information require a long-term commitment from the host organization because the data have a long useful life. The development and maintenance of the skilled staff required to support these databases are critical to the success of a database project. The training of skilled staff takes several years; in contrast, hardware and software can be delivered within a few weeks or months.

2. Types of geoscience information projects

109. There are three types of projects, each of which has particular requirements to ensure successful implementation.

(a) Building a database from existing hard-copy information

110. For example, an organization with documents produced over 40 years of extensive geological investigations, which are housed within a well-run library or archive, is in an ideal position to undertake a database project in which the conversion of the data to computerized format is the major activity. In larger projects of this type, 80 to 90 per cent of project cost is for the data conversion and the remaining funds are for database design and system purchase and implementation. In some developing countries this ideal situation does not exist. The geological field-work may have been carried out, but the documents recording these activities are either in a disorganized state or even completely missing. It is essential that the source documents for an information project are all accounted for and well organized. If documents are not present within a country, they may be available in the geological organizations of an ex-colonial Power. Quality and coverage of data, as well as the local infrastructure to support the project, must be assessed prior to the commencement of the project.

(b) Building a database by reinterpreting or reprocessing existing data

111. A basic requirement is that the source data must be of sufficient quality and geographic coverage to justify the cost of reinterpretation or reprocessing of the data and creating the database. Examples of this type of project are (1) creating a database of the geology of a country incorporating modern geological concepts, in order to publish a new national geological map; and (2) processing aeromagnetic data displayed as profiles on paper maps so that the end product is a database of gridded data that can be displayed as shaded relief models.

(c) Building a new database by collecting new data in the field and adding them to the database

112. As this project does not depend on existing data, the project has full control of the quality of the final database. An example of this type of

project would be building a database on small mines by visiting all the mines, filling in data sheets on each mine and subsequently entering the data in the computerized database.

3. Elements of a successful geoscience information project

(a) Design

113. A project must be designed to take into full account the local conditions under which it will be implemented. The following should be considered in the design of the project:

(a) Overall purpose of the project;

(b) State of existing data, if part of project;

(c) Skills of staff assigned to project;

(d) Local infrastructure;

(e) Existing equipment.

114. The design should be modular and incremental, with each module having well-defined deliverables. Only after one module is successfully completed should the next module start. The technical difficulty of a project should match the capability of the staff of the agency that will carry out the project.

(b) Training

115. The training for one module should prepare staff for the next module. It is critical, especially at the start of the project, that in each module the training take into account the skill level of the staff. Training courses should be given throughout the life of the project and relate to the current or upcoming activities of the project. The courses should cover all skills required and should not be confined to computer skills. Upper management of the agency should be provided with a familiarization course on information management. Courses for geological and computer staff should be provided in project design, project management and documentation, as well as on specific computer topics. If the project is a large one with many data-conversion staff, the concept of training the trainers should be used. For example, documented procedures developed during training by local professional staff should be used by data conversion operators during building of databases; these procedures should form the basis of a course given to the operators by the professionals who developed them.

(c) Staffing

116. Local staffing for the project should be large enough to manage it and should be fully involved in database design and the implementation of the project. Only through complete local ownership of the project will the project be technically self-sustaining. Large data-conversion projects (for example,

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building a large map database from hundreds or thousands of maps) are very labour intensive and thus expose many people to working with high technology. Ideally there should be continuity of staff on the project (low staff turnover and minimum staff reassignment) so that the project benefits from the training it provides.

(d) Technology

117. New technologies for the storage, retrieval, analysis and display of data, especially spatial or map data, which are central to the activities of geological surveys, offer extraordinary opportunities to improve the effectiveness of geological surveys in performing their activities and communicating the results of these activities to their clients. The introduction of these new technologies is at an early stage in surveys in the developed world. Surveys that introduced mainframes and minicomputers over the last 20 years have such an investment in their equipment that it is difficult for them to move quickly to the more recently introduced and highly cost-effective technologies such as workstations. This provides an opportunity for surveys in the developing world to move directly to the new technologies which are well suited to the demands made by projects designed to handle integrated geoscience databases, the modern approach to geoscience information. The introduction of the new technologies offers a paradigm shift which can enable those who recognize it to move to a leading position.

118. The selection of hardware and software technology is based on the complexity of the project to be carried out. This selection is made in the latter part of the project design and takes into consideration the technology currently used in the organization as well as that used in agencies with which the geological organization must interact. Standardization of software, such as word-processing software is often useful but can be harmful if applied to complex application areas, such as geographic information systems, that require the use of map data by many disciplines with a wide range of different types of data and analysis requirements.

(e) Technical support

119. Technical support is critical to the successful implementation of information projects and begins well before the start of a project. The Mineral Resources Branch of the Department of Economic and Social Development has conducted interregional and regional seminars to introduce geoscience information concepts and projects. Once a project is proposed and subsequently approved, a range of services, such as project design, training and study tours, management services and consulting services for specific technical topics, are required to support the project.

4. Opportunities resulting from availability of geoscience information

(a) Government policy

120. National geological surveys are providers of information that is used by Governments to define policies on natural resources, natural hazards and the

environment and provides the basis for the implementation of these policies. The introduction of information systems in developing nations will enable existing and new data to be used more effectively to assist Governments in their policy goals.

(b) Foreign investment

121. If a developing country wishes, over the next decade, to be competitive in attracting foreign investment for mineral resources development, it will be essential to provide computerized geoscience information services to support mineral exploration. The issue is one of efficiency: exploration is an information-based activity, requiring comprehensive and well-organized data. The ability to use computers to search and display these data, including geoscience map data, radically improves the cost effectiveness of the search for mineral resources. This reduces the cost of exploration and increases the potential for a successful outcome.

122. Computerized data are compact and easily transportable. They can be analysed at the home base of the potential investor and thus form an essential part of a package to attract investment. The ability to develop such an information package also reveals to investors the capability of the country in which they are being invited to invest.

V. RECOMMENDATIONS OF UNITED NATIONS MEETINGS AND SEMINARS RELATED TO INVESTMENT IN THE MINERAL RESOURCES SECTOR

A. Interregional Seminar on Mining Taxation

(Montreal, 30 September-4 October 1991)

123. The Science and Technology, Energy, Environment and Natural Resources Division of the Department of Economic and Social Development, organized the Seminar in collaboration with CIDA and the Canadian Institute of Mining, Metallurgy and Petroleum, under its mandate for policy guidance in the field of mineral resource development.

124. Because of their capital-intensive and high-risk nature, mining activities in developing countries are critically dependent on attracting foreign investments under conditions that, while ensuring government revenues, also provide a fair return to private investors commensurate with the risks they have taken. Experience suggests that a sound mineral taxation regime is one of the keys to promoting such investments; conversely, inappropriate tax rules may make projects that are otherwise commercially viable unattractive to investors. They may also reduce the fiscal revenues from mining operations.

125. However, a tax regime acceptable to all parties is difficult to formulate. At issue is the question of how both industry and Government can reap financial benefits in a win-win situation, providing acceptable profits to the mining company while ensuring that non-renewable resources are used wisely, that compensation is fair and that the rights of future generations are protected. The United Nations is cognizant that every country has its own identity and development goals, and every mining company its own strategy. The Seminar was

therefore designed to provide a variety of views and options to assist each country in selecting for itself the measures best suited to its purpose.

126. The Seminar, while addressing many issues in mineral development, suggested the following objectives for Governments in designing fiscal regimes: a fair financial return for their resource; benefits for the economy as a whole, especially the development of local industries; opportunities for education and training of the country's nationals and achievement of transfer of technology; and assurance that the Government bears as little risk as possible. Proper environmental protection is now an equally important consideration. Critical objectives for industry include: a taxation system that permits an acceptable rate of return on investment; certainty of long-term rights to the minerals that are to be developed; contractual, legislative, and political stability; and assurance that management and operations can be conducted on a commercial basis.

127. A series of industry and government presentations provided details and examples of these principles. The World Bank paper described an enabling environment for mining exploration and investment, including a fiscal regime with the following features: fixed, non-negotiable, mineral-sector tax terms; profit-related taxes rather than duties and royalties; taxes universally applicable to foreign, domestic, and State enterprises; incentives such as accelerated depreciation rather than tax holidays; taxes competitive with those of other mineral-producing countries; and avoidance of double taxation through tax treaties. It was pointed out that a variety of tax mechanisms were available and they should be selected on the basis of their contribution to Government objectives, for example, short-term revenue or accelerated development, steady revenue or higher participation in bumper profits. Several papers emphasized the importance of a well-administered fiscal regime. A computer model was used to demonstrate the powerful effects of tax rates and structures on profitability.

128. Other papers considered the fiscal implications of government equity participation in mining projects and presented descriptions and instructive analyses of the different fiscal policies and experiences of Canada and Chile in securing revenues and promoting investments. The fiscal significance of small-scale mining activity in Africa was found to be less important than its contribution to mineral discoveries.

B. Interregional Seminar on Applied Finance for Natural Resources

(Bangkok, 9-14 December 1991)

129. The Science and Technology, Energy, Environment and Natural Resources Division of the Department of Economic and Social Development convened the Seminar in conjunction with the Economic and Social Commission for Asia and the Pacific (ESCAP) to ensure that executives and managers in developing countries are in a better position to allocate scarce resources to define and evaluate natural-resource projects, by familiarizing them with the skills and tools used by the world banking community for such purposes. For want of such knowledge, some 75 per cent of all projects fail. The Seminar framework was developed as

a series of case studies, supplemented by lectures and discussions. Senior officials of financial institutions acted as resource persons.

130. Mining finance can be defined as the management of a mining company's money, including the raising of funds. Project financing usually involves three major players: sponsor, investor and financier, each of whose perspectives are different. The objective is to minimize risks to lenders and maximize the return to investors. Sources of finance include equity; debt, such as commercial debt, mezzanine financing and agency (World Bank etc.) financing; debt/equity swaps; credits; leasing, and pre-production sale of products, such as gold loans. Debt finance is generally not available for exploration or small mines. Details of each class of finance were provided at the Seminar.

131. The structuring of finance in terms of debt and equity and the assessment of and protection against risks demand careful management and organization. Risks include (i) those outside company control (reserve, market, infrastructure, environmental, political, *force majeure*); (ii) those within company control (operating, participation, engineering and completion); and (iii) those within the bank's control (syndication, funding and legal). A firm understanding of risk sharing is essential. Leasing/tax benefit financing was introduced at the Seminar as a means of utilizing tax law to enhance economics for the project and/or for investors or lenders. It is particularly interesting as a means of avoiding large cash outlays and saving money in other ways, and is especially beneficial when exporting to countries with soft currencies.

132. The Seminar concluded by recommending that more training seminars and workshops on finance and related matters should be held in developing countries; that developing country resource persons should also be trained; and that a market development seminar should be held.

VI. CONCLUSIONS

133. Modern mining and processing methods are very capital-intensive and their attendant infrastructure is so large that developing countries will have to rely increasingly on foreign investments for the development of their mineral resources. In attracting foreign capital for the development of their mineral sector, the Governments of developing countries should therefore pay particular attention to their policies and procedures as they apply to foreign enterprises and attempt to make them competitive.

134. There are a number of bilateral, multilateral and private sources which can assist developing countries in establishing ways and means of attracting foreign capital and in financing the development of their mineral resources.

135. The feasibility of successfully establishing geological information projects in developing countries depends primarily on project design and the care with which it is carried out. A project that is not sensitive to local conditions will fail to a greater or lesser extent. A majority of developing countries require assistance in both technical and management aspects of implementing a successful geoscience information project.

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Notes

1/ See International Monetary Fund, Primary Commodities, Market Developments and Outlook (Washington, D.C., July 1990), chap. V.

2/ World Economic Survey 1990 (United Nations publication, Sales No. E.90.II.C.1), chap. III.

3/ "A global survey of mining company investment preferences: mining investment conditions in selected countries of the Asia-Pacific region" (ST/ESCAP/1197).

4/ A similar seminar was held in Canada for the United Republic of Tanzania at Prospectors and Developers Association meetings. The project was funded mainly by CIDA with arrangements made by Romanex International Ltd., a Canadian junior exploration firm active in the United Republic of Tanzania.

5/ Mining Annual Review (London), 1992.

6/ Ibid., p. 95.

7/ Mining magazine (London), October 1992.

8/ Mining Journal, vol. 319, No. 8201 (27 November 1992).

9/ Mining magazine, September 1992, p. 192.

10/ Ibid., April 1992, p. 25.

11/ Mining Annual Review (London), 1992, p. 132.

12/ Ibid., p. 53.

13/ Metals and Minerals Annual Review (London), 1992.
